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COMPUTERWORLD

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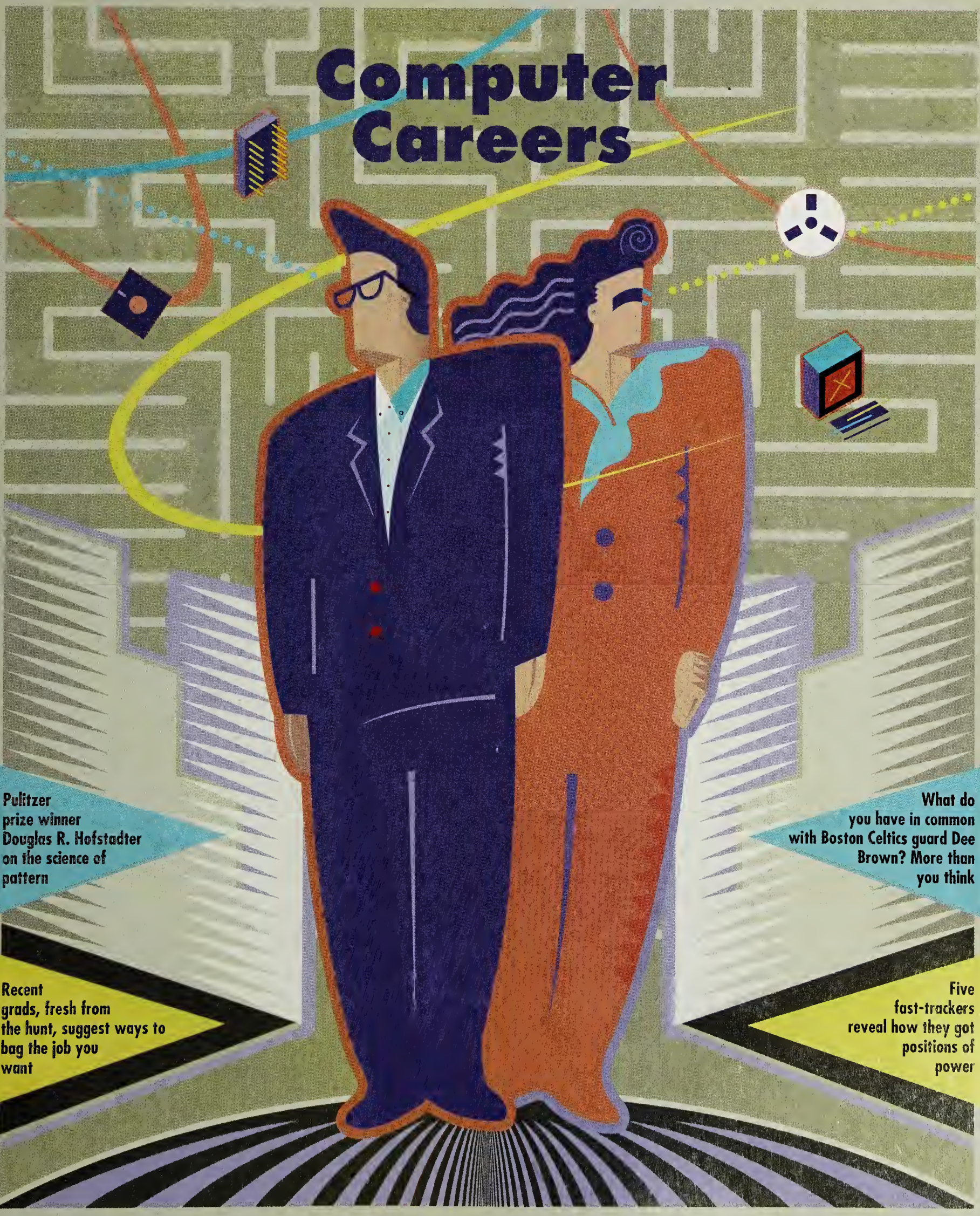
Computer Careers



Pulitzer prize winner Douglas R. Hofstadter on the science of pattern

What do you have in common with Boston Celtics guard Dee Brown? More than you think

Recent grads, fresh from the hunt, suggest ways to bag the job you want

Five fast-trackers reveal how they got positions of power

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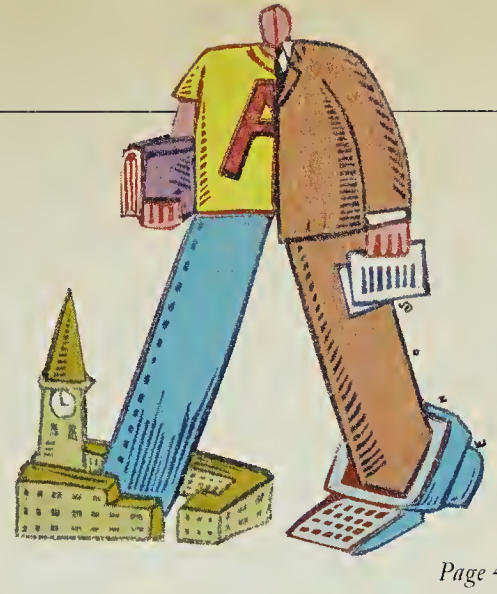

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Cover illustration
Steve Lyons

BEYOND THE OBVIOUS

This magazine is not just about how to turn a degree in computer science or electrical engineering into a job. Of course we want you to become productive, gainfully employed members of society, and we know it can be tough out there these days, so you'll find lots of nitty-gritty advice here about how to collect the right experience and how to pursue and land the position you want.

However, we also want you to understand that, despite all the bad news about hiring cutbacks and reduced expectations, this is a time of fresh challenges and amazing possibilities for those who are willing to experiment, explore and maybe even venture into areas that aren't exactly traditional.

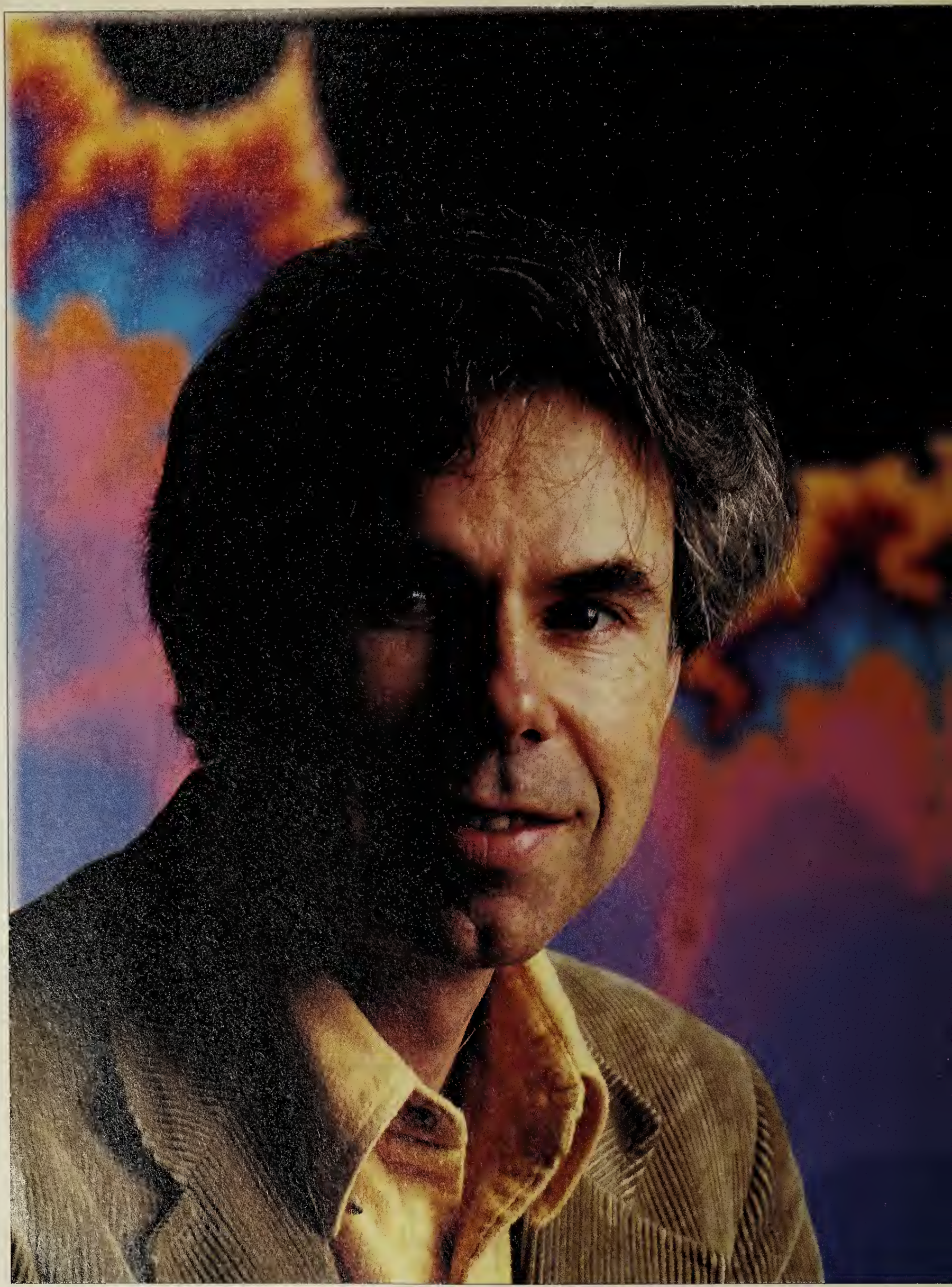
The starting pay may not be much. Few companies this year are rushing to hand out huge salaries to new graduates. But then again, according to Mark Teflian, president of Covia Technologies and one of the fast-track industry stars profiled inside (see page 46), that sort of generosity wasn't prevalent when he got his start at United Airlines, either. He had to burn some midnight oil and pay some dues before he hit the high brackets.

Bill Gates sees lots of possibilities ahead, especially for those who have skills that can help make personal computers truly personal (page 37). So does Laszlo A. Belady, the head of Mitsubishi's new research facility in Cambridge, Mass. There's plenty of work to be done in the field, Belady says, and the more well rounded you are, the better suited you'll be to handle the work (page 19). Computers and computer sciences have become the hub of most activities that make up daily life and, as author and professor Douglas Hofstadter points out, they form the central discipline of just about every kind of scientific exploration (page 5).

With your training, you can be and do almost anything. If the job you want isn't in the classified section, take a hint from some of the folks we're featuring and invent it.

Joanne Kelleher Lory Zottola

ILLUSTRATION BY TERRY ALLEN



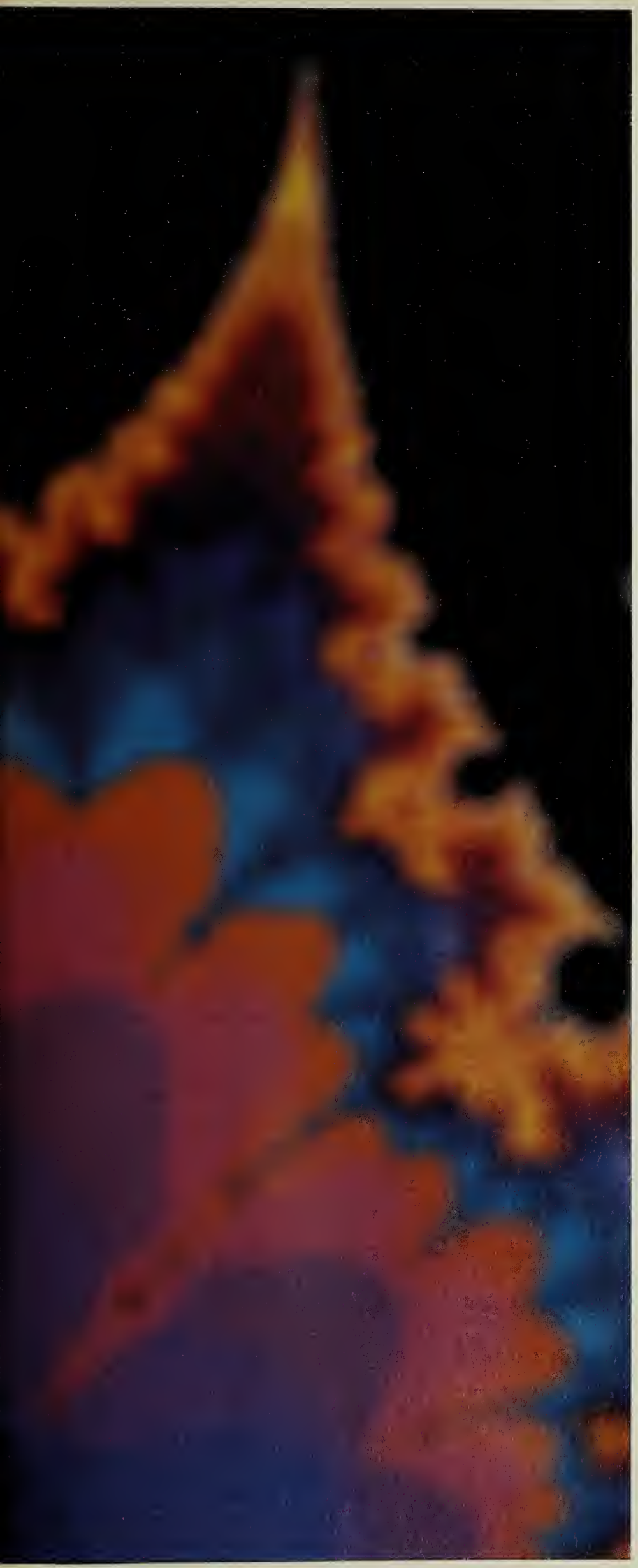


PHOTO BY RICK DIERINGER

Pulitzer Prize-winning author and professor Douglas R. Hofstadter explores the expanding realm of computer science

The new science of pattern

"Computer science" seems like a straightforward term, one that tells you exactly what it stands for. But I would argue that computer science is far more than the science of computers — digital circuitry, programming languages, operating systems and such. To me, computer science is about patterns in their broadest sense — provable or unprovable, tangible or intangible, scientific or artistic, static or dynamic, repetitive or unpredictable.

Imagine a huge and beautiful underground cavern with a gigantic central gallery off of which branch many large grottos. Each grotto is uniquely shaped and exquisitely colored. Now imagine that off of each grotto there branch many smaller side grottos and, off of those, branch yet smaller ones. Thus there are tiny grottos just right for a mouse to enjoy, smaller ones just right for a flea, minuscule grottinos for subfleas. And it doesn't stop there — it just keeps on going like an infinite Russian doll.

It would be delightful to explore the wonders of this incredible cavern, but as a human, you would be limited to the larger grottos — and rumor has it that the smaller the grottos are, the grander they are.

Until the arrival of the computer, we just had to live

with frustrations like that, in everyday life and in the sciences — but now, even though we still can't squeeze our fleshy selves into the tiny spaces our imaginations can create, we can follow patterns to their furthest reaches. Our dream cavern, for example, has an amazing computer counterpart: the so-called "Mandelbrot set," a fractal shape discovered just over 10 years ago by the computational explorer Benoit Mandelbrot, working at IBM's Watson Research Labs.

The Mandelbrot set is a mathematical structure that has infinite levels of detail, and by now it has been explored by thousands of "mathenauts" (to borrow a term from mathematician Rudy Rucker). To explore the Mandelbrot set, you merely need to know the formula that defines it and to have a computer capable of graphic display (with color, if possible). Then you pinpoint a rectangle to explore by typing in the coordinates of its corners, and you let the computer go to work.

Pretty soon, a spectacular set of jewel-like swirls will appear on your screen. Perhaps one of its many intricate excrescences will draw your eye, and your next choice will be to blow up that tiny bump so that it again fills your screen. You can change your scale at will, becoming a mouse, a flea, a subflea, an atom....

The point is that in the last 30 years, computers have had a profound effect on mathematics. Extremely abstract and arcane ideas are becoming more visualizable daily, and it is becoming respectable to be a "computational mathematician" — one who explores structures with the aid of computers and doesn't worry too much about the traditional crux of mathematics: theorems and proofs. Thanks to changing perspectives, new grottos in the vast cavern of mathematics are being explored.

The ever-bifurcating science of computers and computation has opened up new possibilities in other sciences as well. Take theoretical physics, for instance.

When I was a graduate student in solid-state physics, my adviser posed a fascinating mathematical challenge to me, one that he had distilled from decades of trying to understand the distribution of the so-called "energy bands" in a crystal in a magnetic field. He was a superb theorist and had tried every trick in the book to crack it, but it just wouldn't yield. I was nowhere near him in terms of knowledge of fancy mathematical techniques, but I knew how to program, and he didn't.

THE GALAXIES CAN BE UNDERSTOOD IN A DIFFERENT WAY WITH A DESKTOP COMPUTER

Somewhat sheepishly, I resorted to numerical calculations, just to develop a better knowledge of the equations we were dealing with. I had at my disposal a 1974 Hewlett-Packard Co. desktop calculator, about a thousand times slower than a typical desktop computer of today. I would let my little friend run all night computing the endpoints of various short line segments representing the elusive energy bands, and in the morning, I would arrive at my office and proceed to plot these line segments by hand on graph paper. It took weeks for the entire plot to take shape in this manner.

The output had a surprisingly complex appearance, and at first, I could make no sense of it. But after the first week or so, I started to see amazing patterns I had never suspected, and each new night's run confirmed my intuitions. Since this machine seemed to be producing gold overnight, we dubbed it "Rumpelstiltskin."

Eventually, I realized that my "golden graph" was composed of tiny distorted copies of itself, which were, in turn, composed of tinier distorted copies, and so on — rather like the Mandelbrot set (although that set hadn't yet been discovered).

My adviser at first resisted my discovery with all his might, but eventually the pattern became so undeniable and so obvious that he came around. In fact, he came to love that graph enormously — even though neither he nor I could ever prove its beautiful nesting properties.

Even the cosmos is yielding up some of its hidden depths to computerized explorers, often astrophysicists working in computer science departments.

It used to be that if someone wanted to understand how galaxies evolved, either one studied abstruse but very simplified mathematical models or looked heavenwards and tried to draw lessons from the essentially static pictures above one's head. But today, a galaxy can be simulated in a computer on a desktop. Each star is a point interacting with thousands of other points via "simulated gravity."

The stars exhibited on the screen can be seen pulling one another and forming elaborate swirling patterns that eventually turn into the familiar spiral arms of real galaxies. By toying with the initial conditions or even the nature of the gravitational force, alternative evolutionary pathways of a galaxy can be observed.

Biology, too, has been invaded by computational models. People have programmed simulated flocks of birds, schools of fish, ant colonies, ferns, trees and forests and have even invented self-reproducing programs with their own quota of "genes." Such hypothetical beasts compete with one another for ecological niches in an artificial environment, undergoing mutation and even sexual recombination (well, sort of) to form new and unimagined beasts. And it shouldn't surprise you to know that many, if not most, of the practitioners of this new art form known as "artificial life" are computer scientists.

What ties all of these scientists together is that they are obsessed with patterns. What this means is that all of them,

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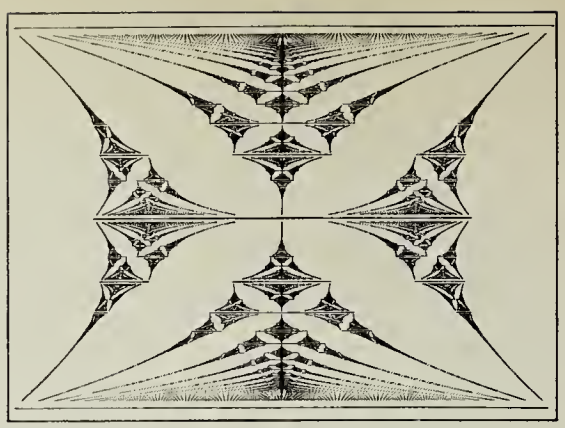
Continued from page 6

whether or not they actually use computers, are to some degree computer scientists because computer science has usurped the role that mathematics once played — it has become the *central discipline of pattern.*

The reason for this usurpation is that mathematics is a domain in which properties of patterns matter only if they can be proven. With the arrival of computers, patterns far too complex to quantify have been discovered, and for them proofs are often entirely unavailable. Even when they are available, they are far less convincing than vivid graphics on a screen.

I sometimes wonder, "Is what I do really computer science?" Ironically, despite having been a professor of computer science for many years, I have gotten far away from programming, even from thinking about computers at all. What I *do* think about are the abstract principles that I believe underlie human thought.

I study human analogy making and error making. I look at the fine line between what people find humorous and what they find unfunny, trying to figure out the boundaries between nonsense and sense. I



THE 'GOLDEN GRAPH'

observe human memory and try to see how one episode triggers another. I try to pin down the elusive difference between concepts and words.

In some ways, I might seem more like a philosopher than a computer scientist. And yet I am not content until my ideas have become concretely realized as programs. It is my graduate students who do so, taking my ideas and modifying them, extending them, simplifying them and ultimately converting them into nitty-gritty code. I simply don't consider an idea to be complete until it has been spelled out so concretely that a machine can carry it out.

Unlike people who, in previous centuries, had similar passions to explore the mind, I was not condemned to be a philosopher. I was lucky to have been born in the age of computers, so my fascination could give rise to much more than idle musing.

Yet, despite all the awesome computational power literally (and I mean literally) at my fingertips, I am sure that the paradox of trying to bridge the gap between that plastic box a foot in front of me and the plasticity of the mechanisms inside my own little skull will tantalize and entice me for the rest of my life. ■

DOUGLAS R. HOFSTADTER IS A PROFESSOR OF COMPUTER SCIENCE AND COGNITIVE SCIENCE AT INDIANA UNIVERSITY IN BLOOMINGTON, IND., AS WELL AS AN ADJUNCT PROFESSOR IN THE DEPARTMENTS OF PSYCHOLOGY, PHILOSOPHY, HISTORY AND THE PHILOSOPHY OF SCIENCE. HIS FIRST BOOK, *GODEL, ESCHER, BACH: AN ETERNAL GOLDEN BRAID*, WON THE PULITZER PRIZE IN 1979. SINCE THEN, HE HAS PUBLISHED TWO OTHER BOOKS: *THE MIND'S I*, WHICH HE CO-EDITED, AND *METAMAGICAL THEMAS*, A COLLECTION OF HIS COLUMNS FOR *SCIENTIFIC AMERICAN*.

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How to get your foot in the right door

BY KATHLEEN GOW

Recent grads share tips on finding and snagging plum positions

Even with an economy that's in the doldrums and all the headlines about downsizings, plant closings, layoffs and the like, recent graduates say it is possible to land good jobs in the computer field.

Work experience definitely helps. Graduates strongly recommend getting some practical IS experience, even if it's 10 hours a week in your last semester. (For more information on how to get experience, see story page 41.) But persistence, resourcefulness and knowing how to make good use of every opportunity also have a lot to do with finding work, they say.

KATHLEEN GOW IS A FREE-LANCE WRITER BASED IN MEDFORD, MASS.

ILLUSTRATIONS BY LESLIE COBER

What follows are some practical suggestions from your predecessors on how to find the job that's right for you and how to improve your odds of getting it:

■ **Take advantage of the placement office.** One of the easiest places to start is right on campus — at your placement office. Grads agree that the services offered, from resume-writing and interviewing tips to setting up job interviews with recruiters, are invaluable. Placement offices also have a variety of helpful publications, such as alumni directories, recruiter directories and national directories that list companies by region, occupation and industry grouping.

Virginia John, who graduated in June 1991 from MIT with a mathematics degree and a complement of computer science courses, took the idea of working the campus placement office literally — she got herself a part-time job there. John says that job helped her discover what industries were hot, what kind of work she wanted and where she wanted to go. It also gave her the opportunity to speak directly with recruiters for the company she decided to target — Hewlett-Packard Co. Today she's a solutions integration specialist there.

■ **Get help from professors.** You can also often get personalized help or an "in" with a potential employer through faculty, recent grads say. IS professors can greatly simplify the employment search, says Elizabeth Guebert, a 1990 University of Georgia MIS graduate who landed a job as executive information systems (EIS) administrator at North Carolina National Bank, Inc. in Charlotte, N.C., in June 1990.

Guebert's name was passed on to the bank by Hugh Watson, head of the school's MIS program and an EIS specialist. Watson learned of Guebert's skills while working with her on EISs in the school's "smart office." Guebert's campus job was to maintain systems in the smart office lab, a presentation room built with a $5 million IBM grant.

Professors often hear about unadvertised positions in companies they work with as consultants, says former computer science student Rajiv Dalal. Now an assistant to the vice president at Citicorp's Technology Office in New York, Dalal has a degree in computer science from London University and a 1990 MBA degree from New York University with a concentration in finance and international business.

It was his dual understanding of technology and finance that eventually got him his job, Dalal says, but he would never have learned of the position without his professor's help and some luck. He happened to be walking past his IS professor's office at the moment a Citicorp personnel officer called with a position to fill.

■ **Target recruiters.** Another way to improve your chances of getting interviews is to "get to know recruiters and give them some reason to remember you," says S. Jonathan Horn, who graduated in 1990 from New York University with an MBA in IS.

Horn says getting to know recruiters while applying for internships (he had one at Mobil Oil from January 1989 to May 1990) was a big help when it came to the real thing — a job as a consultant at Andersen Consulting in New York. He contacted recruiters from lists published by NYU and also from a guide to recruiters put out by Harvard University in Cambridge, Mass. In some cases, he even checked with directory assistance to see if one of his target companies was located in a city where he wanted to work. If so, he'd call and ask them to send him information.

■ **Diversify your efforts.** Kate Whitmore turned down offers from Arthur Andersen and Price Waterhouse to accept a job as a litigation analyst in the systems department at Toledo, Ohio-based manufacturer Owens-Corning Fiberglas Corp. Whitmore credits both her IS work experience (three years at McDonnell Douglas Corp. and a summer internship at General Electric Co.) and strong communications skills for her success.

A 1990 grad from Indiana University with an MBA in IS, Whitmore spent about 25% of her effort in a letter-writing campaign to companies whose names she culled from placement office employer directories. She got one interview from the 100 letters she sent out. "That just didn't work for me," Whitmore says.

What did work was taking part in the campus recruiting program, where she spent most of her effort, interviewing with nearly two dozen firms and ultimately choosing Owens-Corning.

Hubert Kwan, who augmented his MIS degree with an MBA in finance in 1991 from Boston University, also participated in campus interviews, but he found that the sluggish New England economy had forced many companies to cut back their on-campus recruiting. With fewer on-campus companies to choose from, Kwan, who now works at Bank of Boston, put his efforts into combing the want ads.

■ **Find a sponsor.** Steve Bacastow recommends finding a sponsor at a company to help get you an interview, if not a job.

Bacastow found his sponsor, one of the founders of Atlanta-

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based Global Concepts, Inc., a financial services consulting and research firm, in an unlikely way — through jogging. After striking up an acquaintance, Bacastow kept his fellow runner up to date on his career objectives. By the time he graduated from Georgia State in 1989 with a degree in information systems, he had landed a job with Global Concepts.

Bacastow, now vice president at International Shared Solutions in Atlanta, realizes his particular route won't work for everyone, but he does recommend a direct form of approach. Ads pull so many responses these days, he says, that you should try to send your resume directly to someone senior, bypassing overloaded personnel departments. He suggests asking professors and friends for names at a company and checking placement office directories of alumni for other contact possibilities.

That kind of networking worked for Horn. He got the names of grads who worked in Andersen's New York office from friends and called them to learn more about the firm and their jobs.

■ **Be aggressive, not complacent.** When Bank of Boston canceled its schedule to interview on campus at Boston University, Kwan was undaunted. Even when the bank turned him down as too inexperienced for a position he applied for through the want ads, his determination did not falter. Today, Kwan works at the bank as a senior systems analyst.

Kwan says he viewed that initial rejection not as a failure but as "a point of contact," hoping he'd be called for an interview if a more appropriate position became available. Sure enough, that's just what happened. Several weeks later, the bank's technical recruiter called him about the position he now holds.

Like Kwan, Bob Mader didn't give up. A 1990 graduate of the University of Minnesota's MBA program with an IS concentration, Mader had no success with on-campus interviews. He felt his nontechnical, teaching background worked against him, especially going head-to-head against students with IS work experience.

With no full-time position in hand upon graduation and needing experience, Mader accepted a temporary IS job at The Methodist Hospital in St. Elizabeth Park, Minn. He continued to look for permanent positions and kept in touch with his network of contacts. That paid off when a friend he had worked with on a field project in his IS program called to let him know of a five-month opening at The Pillsbury Co. in Minneapolis.

At the end of his stint, Mader was hired permanently as a systems administrator in the operations systems department.

To keep your motivation and spirits up when you're jobless, Mader recommends joining a community job hunters' support group sponsored by schools, civic societies or church groups. The support groups are also listed in local papers. ■

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EDUCATION WORLD TOUR '91

BY LISA GUISBOND

Ever wonder what university-level technical education is like in other countries? Well, we thought we'd find out, so we went straight to the sources — students from five nations. These individuals talked about what their courses are like and the unique issues they regularly deal with on their way to a degree.

LISA GUISBOND IS A FREE-LANCE WRITER BASED IN CAMBRIDGE, MASS.

YUGOSLAVIA
Milos Milacic, 24
Bachelor of science degree candidate in electrical engineering
Michigan Technical University
Houghton, Mich.
(Recently transferred from Belgrade University)

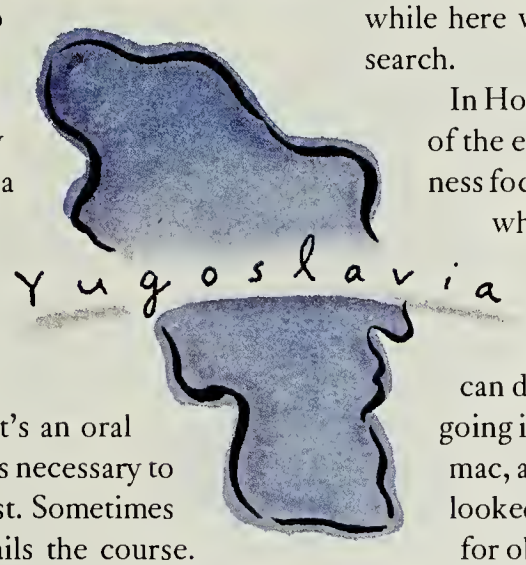
Unlike the American system, we don't have electives in Yugoslavia. We have a program that has to be completed. The only thing we can elect is our electrical engineering field of study — communications, electronics and so on.

There are quite a few humanities courses in the program. We have languages and philosophy, including the philosophy of war: the reasons war is waged, how to prevent it and things like that.

In Yugoslavia, higher education is sponsored by the

ILLUSTRATIONS BY MARY LYNN BLASUTTA

state. Even though U.S. students typically pay for their education, they get better accommodations, and they have access to books. Very often, students here have to study from many books — this chapter from this book and that chapter from that book. Or we have to study from notes because the book doesn't exist. It's difficult to study when you go to the library and there are only four copies of a book that 400 students need.

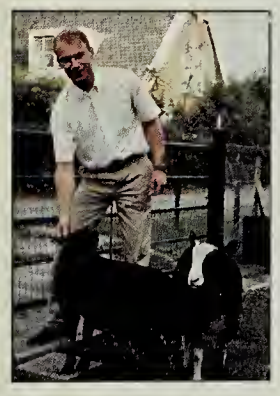


The examination system is also very different. In Yugoslavia, we have exams at the end of the semester or the end of the year.

First it's a written test, then it's an oral test. And to get to the oral tests, it's necessary to get at least 50% on the written test. Sometimes nobody passes it, so everyone fails the course. And the oral exam is a drag, because it depends a lot on the professor's mood.

I think students at American universities study much less than students in Yugoslavia but have better opportunities. What I like about the U.S. is that everybody is measured by his work, not by his ideological thinking — whether he is a good communist or bad communist or good democrat or bad democrat.

In the U.S., nobody asks anybody which party he is a member of or anything of that nature.

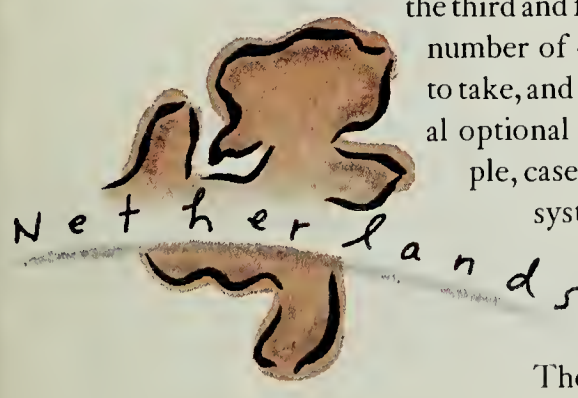


THE NETHERLANDS

Guus Ramackers, 26
Ph.D. candidate in computer science
Leiden University
Leiden, The Netherlands

As an undergraduate, I studied English language and literature, and when I finished that, I started again, this time to pursue a bachelor's degree in computer science. I found the motivation for studying language and literature a bit too vague, while the preciseness and mathematical base of computer science appealed to me.

For the first two years of the computer science master's degree program at Leiden, you have to do a set program. In the third and fourth years, there are a number of core courses you have to take, and then you choose several optional subjects — for example, case studies in information systems, information quantification or advanced programming.



There are no courses in the computer science department that focus on business administration as such.

In America, I believe there's a lot more attention given to the business side of technology — applying systems — while here we're more into modeling and theoretical research.

In Holland, you'll find that subject in the curriculum of the economics department. The most applied business focus in computer science is the case studies in IS, which look at the use of computers in commercial settings.

In the last half year of a master's degree, however, you have to do a thesis, and you can do this either by staying at the university or by going into a company. I did go into a company — Uolmac, a large software house. While working there, I looked into object orientation, particularly methods for object-oriented design. I found the whole experience of actually doing it instead of just studying it very stimulating.

Last year I co-organized a doctoral consortium at the European Conference on Object-Oriented Programming. There were 20 students from Europe and 20 from America who attended sessions discussing differences [in computer science education].

I feel that the American course is a bit briefer: You can do your Ph.D. in, say, two or three years, while here it's more like four or five. Also, there are more formal tests and classes you have to take while doing your Ph.D. in America, while here, you're on your own.

SWITZERLAND

Markus Tresch, 27
Ph.D. candidate in computer science
Swiss Federal Institute of Technology (ETH)
Zurich, Switzerland

Here in Switzerland you get a bachelor's in computer science in two years and three years later a master's. Usually, people stop at a master's, but if you want to go on for a Ph.D., that takes another four years. Most people stay in one subject, so you need to decide the direction you want to take after high school.

There are required core courses for bachelor's and master's programs. The ETH is a technical university, so the core courses are the same for everybody — computer science, mathematics, physics, calculus, linear algebra, numerical mathematics, mechanics and so on.

For students specializing in computer science, there is another set of required courses that we call basic computer science. Completing these takes two years. At that point, you can choose a specialty in one of four areas — systems software, IS, hardware or theoretical computer science.

The program is mostly fixed in the first four semesters. During the next two years, you can choose up to 90% of

what you want to study. There's a booklet of about 50 courses from which to choose.

I think computer science education in Switzerland is particularly good in that it is quite wide-ranging, from theoretical computer science and mathematical computer science to databases and computer systems.

It's possible that there's more emphasis in the U.S. on applied IS because, in America, there are more grants available for basic research at the Ph.D. level from companies or the U.S. Department of Defense, for example.

This is not the case here. We normally get our money from the state, and we are restricted to applied research.

AUSTRALIA

Julian Edwards, 25
Ph.D. candidate in IS
University of New South Wales
Kensington, Australia

At Cambridge University, where I got my bachelor's degree in geography, the geography department ran a course in my third year on geographic information systems (GIS). I took it and became interested in remote sensing and data analysis and other aspects of those kinds of systems.

When I finished at the university, I was quite keen to do a master's course in GIS and wrote to a few universities in the UK. Getting a place was usually reasonably easy, but getting the funding was a problem.

Then I wrote to a professor in the geography department at Liverpool University, and she wrote back and said she was interested in my curriculum vitae, but she was emigrating to Australia. She asked if I would like to go and work with her while pursuing a Ph.D. in IS.

Actually, my Ph.D. is very cross-disciplinary. The area I'm looking at is essentially modeling, using techniques from software engineering and applying those to different areas in economics. One of my projects involves the water industry and economics and IS. So I have a supervisor in the economics department at the university and a supervisor in the IS school. Both are members of the commerce and economics faculty.

IS is a young discipline here, and I don't think the school's been around for more than 10 years or so. But it is getting more organized as far as what core courses they want people to take. The key ones have to do with research topics in IS. There are two courses involved. One is a course on research methods in which you do literature searches and look at the philosophy of research and hypothesis testing modes and that sort of thing.

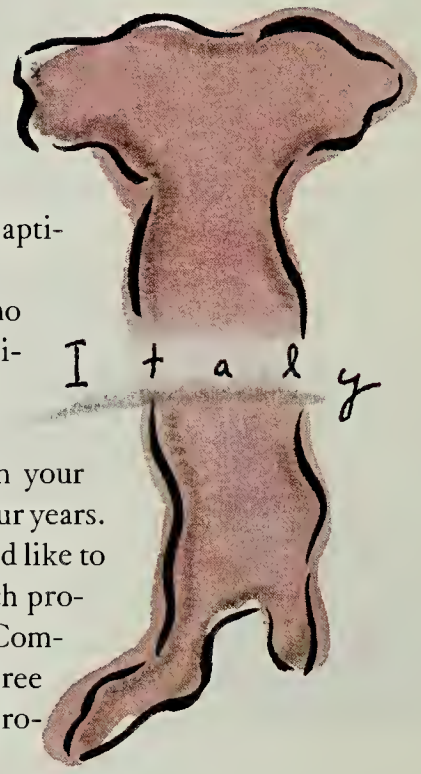
The other course is one in which you go and do research on a computer-related topic and write a paper about your experiences at the end of it. It's a small thesis with a practical emphasis.

ITALY

Danilo Montesi, 27
Ph.D. candidate in computer science
University of Pisa
Pisa, Italy

The program to get a bachelor's degree in computer science here is quite strict. You have to take 18 courses, only three of which are electives.

When I started, no exams were taken before admittance to the bachelor's program. But three or four years ago, the department started up a kind of selective exam, a test to measure your aptitude for computer science.



At the moment, there is no master's level in computer science. A typical bachelor's program lasts four years, after which you can start on your Ph.D., which lasts three or four years. The Italian government would like to standardize the length of such programs to that of European Community countries, which is three years. That's how long my program is.

A really big problem in Italy is the emphasis on theoretical study. For example, not one of us at Pisa has written a line of programming for his Ph.D. Therefore, the only kind of work you can get coming out of the program is that of a university researcher. Few companies are interested in people who have studied things like the theory of semantic concurrency for three or four years. It's too far from the interests of companies.

In the U.S., you can choose between a theoretical kind of study and one that could get you more practical work at a company.

The deadlines for Ph.D.s also aren't as strict in the U.S. I have to finish and discuss my thesis on Jan. 19, 1993, regardless of whether I've had problems with my work or my health. ■

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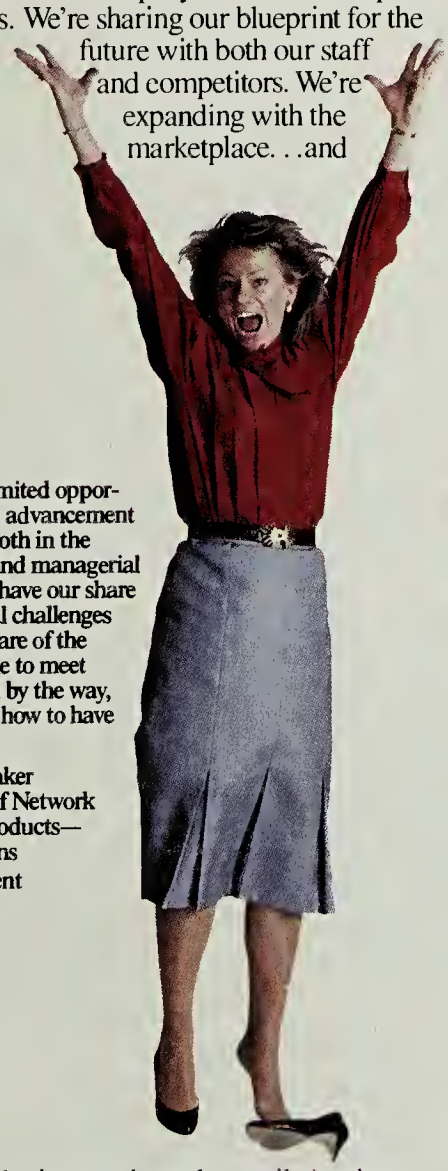

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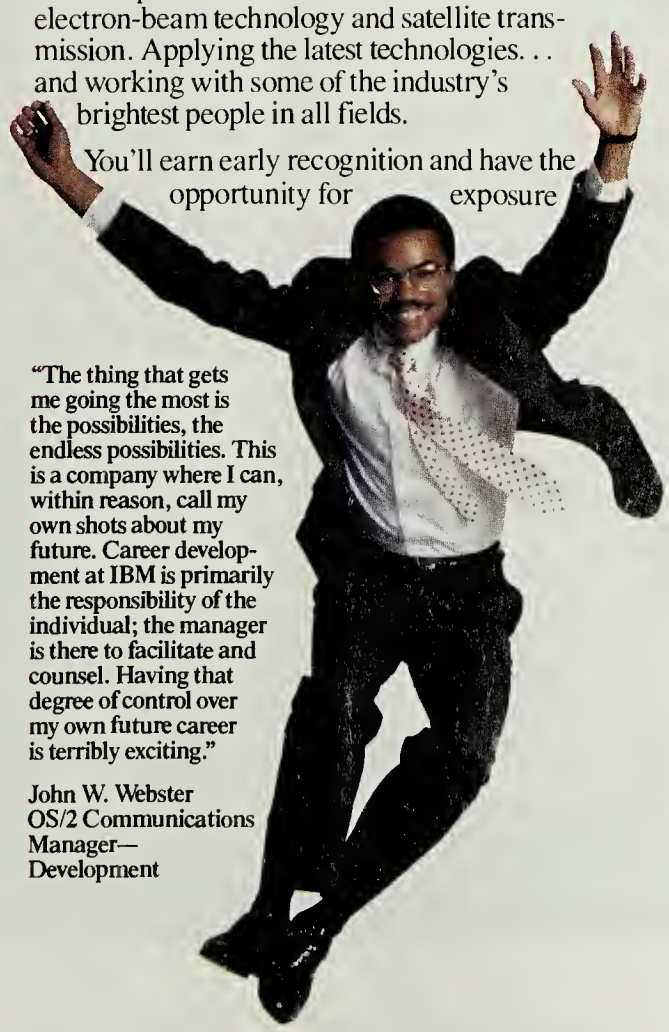

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Company Name	Dept.	
1) _____	_____	A. MIS
2) _____	_____	B. Engineering
3) _____	_____	C. Sales/Marketing
4) _____	_____	D. Technical Support
5) _____	_____	E. R&D
6) _____	_____	F. Other

2 **What job title do you hope to have in five years?**

_____

_____

3 **Why did you choose to prepare for a computer career?**

_____

_____

4 **What undergraduate or graduate degree do you have or are you currently pursuing?**

UNDERGRADUATE	GRADUATE
( ) have	( ) have
( ) pursuing	( ) pursuing
( ) MIS	( ) MIS
( ) Computer Science	( ) Computer Science
( ) Computer Engineering	( ) Computer Engineering
( ) Electrical Engineering	( ) Electrical Engineering
( ) Other _____	( ) Other _____

5 **If you plan to attend graduate school in the next two years, what degree will you pursue?**

( ) business ( ) technical ( ) other

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How to ace (or ice) an interview

BY MICHAEL COHN

Let's face it: It's a good time to be in school and a bad time to be job hunting. Folks are out of work.

Don't panic. You can beat those folks with the three-page resumes, even if your background consists of two Cobol courses and a night job at Wendy's. You just need to know how to interview.

That's where I come in. I've put together a crib sheet of a few of the most dreaded interview questions and a selection of responses. Memorize these, shine your shoes, and even if you don't get an offer, at least you'll know you made an impression.

Q: What areas of computer science interest you?
A1: Gosh, I've never really thought about it. You got anything where you can use, you know, one of those, like, keyboard things?
A2: Distributed relational database architecture. Just thinking about it makes me tingle all over.
A3: None, but for 45K a year, I'll find something.

Q: Are you confident of your communication and interpersonal skills?
A1: No, I'd rather go into IS management.
A2: No, but if you give me five minutes, I'll show you some impressive begging and pleading.
A3: No, but I'm certain that your exciting offer of third-shift tape librarian will sharpen those talents to a razorlike edge.

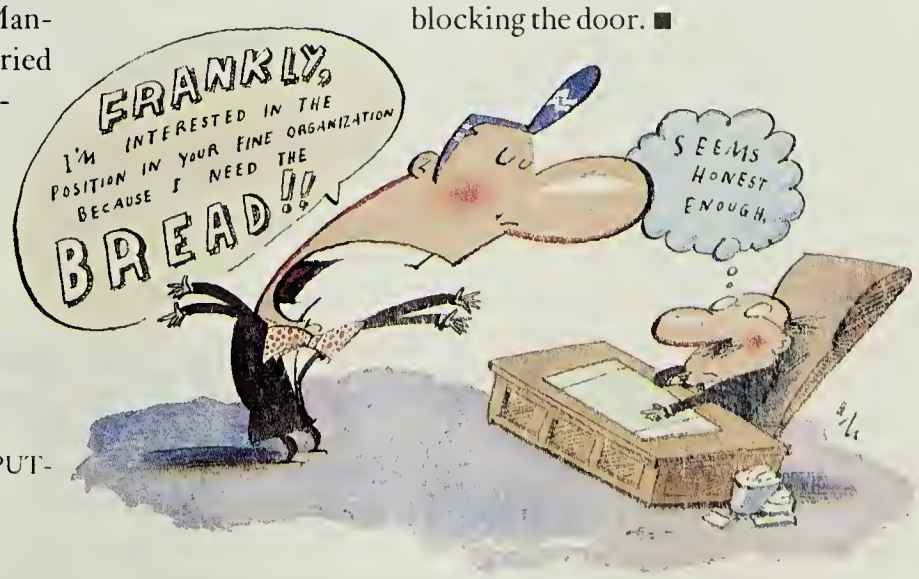
Q: In what languages are you proficient?
A1: Cobol.
A2: Nintendo.
A3: PL/1, RPG, Fortran, Pascal, C, assembler, Mantis, Basic and Natural. Unfortunately, I've only tried coding 'em all in the same program, and I'm having one heck of a time compiling the thing.

Q: Do you have any idea what it's like to be a successful, challenged IS professional?
A1: No, does anybody?
A2: Yes, it's something I've dreamed of every day of my life, and I want it so bad I can taste it.
A3: Yes, but I want to be one anyway.

Q: What are your salary requirements?
A1: Dollars aren't important. I would take minimum wage just to work side by side with the pioneers at your company.
A2: Dollars aren't important. Once I prove I'm right for the job, we can discuss my humble annual salary.
A3: Dollars aren't important. Once I prove I'm right for the job, we can discuss my humble salary, which had better start with a 5 and have four zeros in it.

Q: What are your career plans for the next five years?
A1: I expect to start as a programmer, move up to an analyst, get promoted into first-line management, be hand-chosen as the next CIO and finally gain a seat on the board. From there I'll worry about years three through five.
A2: I can only hope that someday I'll work my way up to a job like yours. I aspire to be just like you — intelligent, dedicated, talented and good-looking, too. Did I mention intelligent?
A3: Make sure that every year I acquire a new technology, a new job skill and a new German car.

Q: Why should we choose you from among the thousands of top college candidates around the country?
A1: Because I asked them all, and they said it was OK.
A2: Because I have the spirit, inner strength and technical curiosity to succeed in your IS department.
A3: Because I outweigh you by 30 pounds, and I'm blocking the door. ■



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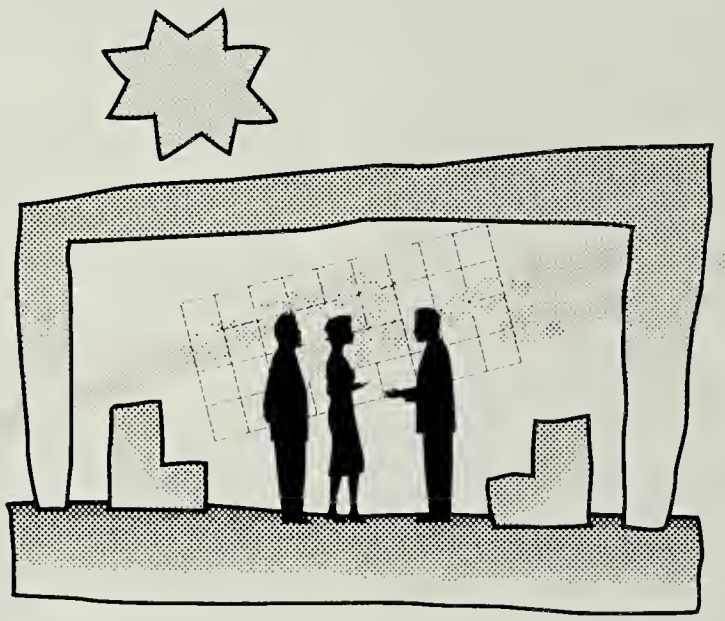

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NARROW is out

Top researcher Laszlo A. Belady advises against excess of specialization

Laszlo A. Belady is chairman and director of Mitsubishi Electric Research Laboratories, Inc., a basic research institute established in Cambridge, Mass., in July.

This appointment is just the most recent chapter in a varied and notable career that has included stints as manager of software engineering at Japan Science Institute (a branch of IBM's worldwide research organization, now called IBM's Tokyo Research Laboratory), and as vice president at Microelectronics and Computer Technology Corp. (MCC) in Austin, Texas.

Belady, who was born in Hungary, began his career at IBM and spent 23 years there before moving on to MCC. In the 1960s, his primary concentration was on virtual machines and virtual memory — notions that he pioneered. During the 1970s, he was a leader in the development of software engineering, and, in his words, "made software maintenance respectable to scientists."

In a recent conversation with Computerworld *Senior Editor Michael Alexander, Belady discussed some of the new challenges for basic research and for those who aspire to a career in the computer industry.*

■ You spent several years managing IBM's research facility in Japan and are now heading up a U.S.-based research facility sponsored by Mitsubishi. What do you see as differences between Japanese and U.S. approaches to computer science research?

PHOTOS BY STEVEN LEWIS

■ I think the most striking difference is the sharp isolation of university and industry in Japan.

Japanese industry does not believe too much in Japanese universities. It believes in the potential ideas of U.S. universities, not those of its own. It doesn't even believe that much in the [human] output of its universities — the graduates. For example, most companies immediately retrain graduates for a year before they give them any important job.

There are some organizational reasons for the separation. In Japan, universities belong to the Ministry of Education, which typically funds and oversees their research. Industry research belongs to MITI, the Ministry of International Trade and Industry. These two ministries are not friends; they are competitors and communicate very little with each other.

Another problem is that university research in Japan is usually abstract and dry. They try to mimic U.S. universities and reinterpret ideas they have picked up from there and European universities. They care too little about ultimately trying to transfer it to industry.

■ What do you think about the quality of Japan's computer science graduates compared with here?

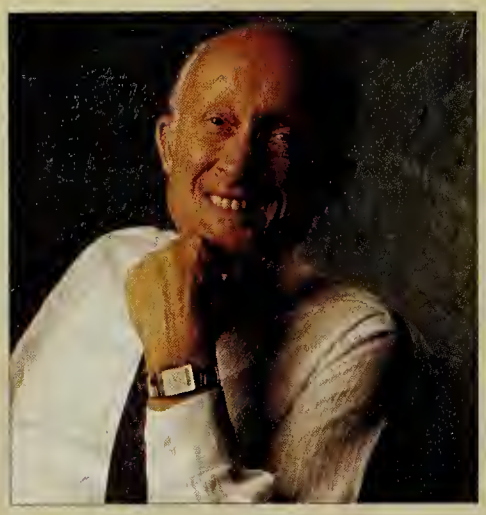
■ They aren't as able to be immediately useful. On the other hand, with respect to the whole Japanese population, I think their mathematical and basic scientific backgrounds are very thorough and very good.

There is another interesting aspect to this: The distribution of talent and capability is skewed differently. We have a small percentage of absolute superstars, then we have lesser stars and finally the plain-vanilla scientist or engineer. In Japan, there are perhaps no superstars, but on average, the scientists and engineers are slightly better than in the U.S.

They miss these superstars and, therefore, many good ideas, but everybody on average is extremely solid and capable. In addition to that, they are avid readers and, therefore, much more aware of a broad selection of relevant topics than in the U.S.

■ Do you see your center interacting to any great degree with the university environment?

■ Very much so. This center is meant to be an open center — not a secret, closed company.



EDUCATION
Aeronautical engineering degree from the Technical University of Budapest

TEACHING WORK
Visiting professor at the University of California at Berkely, London University, University of Texas, University of Minnesota and the Polytechnic Institute of New York

AWARDS
Recipient of the 1990 J. D. Warnier Prize for Excellence in Information

MISCELLANEOUS
Holds nine U.S. patents
IEEE Fellow

We expect to sponsor graduate work and, in the long run, to have postdocs accommodated here who would work with us before they go somewhere else.

I have to build up this organization. We have a very small number of researchers so far, most of whom are senior. We have to have a balanced staff — some senior people but also a large number of young Ph.D.s who are coming out of the universities. That is something we have started doing already.

■ If a young person, a college person, came to you for advice about what to study to prepare himself or herself for a career in computer science, what would you say?

■ I could tell him or her a few things. One of them is, don't take any branch you are studying seriously, but learn how to learn. That is, be flexible and be aware that whatever you learn now is just the basics upon which you will have to build by continuously learning new things as the world changes around you.

I'd say, learn the basics: mathematics, physics, logic. Once you have the basics, you can build any kind of knowledge and expertise by continuing your education, reading research papers and so forth.

Don't be narrow. You should not just learn things that are related to programming. Pick another discipline that appeals to you, because applications-oriented systems design will be the future. For example, be a programmer plus a medical doctor to some degree, be a civil engineer plus a programmer, or be a lawyer who also knows a lot about software.

■ Any insights about which areas of computer science might be the most promising?

■ Probably for the next five years, visualization will be a very fruitful area. So will computer graphics and man/machine interfaces — the whole field of improving communication with machines, whether it involves extension of traditional programming languages, more advanced two-dimensional languages or, in general, the ergonomics of working with computers, making them user-friendly and so forth.

Computer-aided design and very large-scale integration will also be growth areas. So will anything that has to do with efforts that help people work together through the computer.

If you look at the last 30 or 40 years, computers have been supporting the individual. But when it comes to cooperation, we do it outside of computers. The only thing we use the computer for is as a communications device; namely, to send electronic mail to one another.

■ What are you envisioning? That we are going to learn more about using collaborative efforts using technology?

■ That's right. Moreover, not just small teams of hackers working together on a program but more emphasizing the variety of backgrounds of people and how to help people work through computers.

■ Are interfaces and collaborative work processes areas that your center will look at?

■ Yes. We will probably not go too much into languages and very nitty-gritty computer science detail. Our work will be

more applications-oriented. We will probably explore more advanced and potential applications for computers. The general idea is that in the future, advanced countries such as the U.S., Japan and Western Europe will face the problem of putting together teams with varieties of expertise for all different kinds of endeavors, whether it is solving a problem in banking or computerizing a hospital.

These teams will be heterogeneous in nature, so the question is, how can we promote the cooperation and coordination of different experts working together — experts who, at the beginning, don't even understand one another's language? And I mean that both in terms of what they do and the actual languages they speak.

There is a fertile ground to apply computers in this area. We want to do research that supports the dream of having natural cooperative teams working on different kinds of problems wherever they are.

That sounds very grandiose, but as we poke into it, we will probably identify pockets of specific applications in which to explore our ideas.

■ I get the impression that you envision the future of programming to be team-oriented.

■ Yeah. You got it. Absolutely.

■ Is that because our applications will be that much more complex?

■ There are several reasons. The issue is no longer how to program an algorithm or how to hack together a relatively large piece of software. The issue is more and more domain knowledge.

As computer use expands into broader areas, the know-how necessary to coordinate a range of technologies well is more and more on the applications side. Anybody can ultimately put the application together, but to understand that domain is not as easy.

Take the example of a hospital: First you have to understand what kinds of processes and mechanisms exist — not only what the doctors and nurses do but how the building is heated and cooled. We are talking about designing applications systems that actually control a large number of gadgets, some of which are mechanical objects. This is hard for an individual, probably impossible for a team of programmers. Programming is simply not enough.

Designing such an application is definitely an interdisciplinary thing, where the doctors, the building architects and the X-ray technicians have to be working together harmoniously to solve the problem and to come up with a good, reliable system that makes sense and does the job.

■ Are there any kinds of knowledge, any subjects, that you think colleges and universities ought to be teaching more or better?

■ On the fringes of computer science, I would say it is very important to learn much more about communications. We have been talking about the merger of communications and computers for 20 years. Now it is here.

If you are not sophisticated enough to know what communications generally is, what information theory is, what coding theory is, what the properties of available transmission devices are, what the notion of bandwidth is and so forth, you should learn. Such concepts are not being taught today to computer students. I think they should learn more and more about them. They need to be more fluent in communications engineering as well. ■

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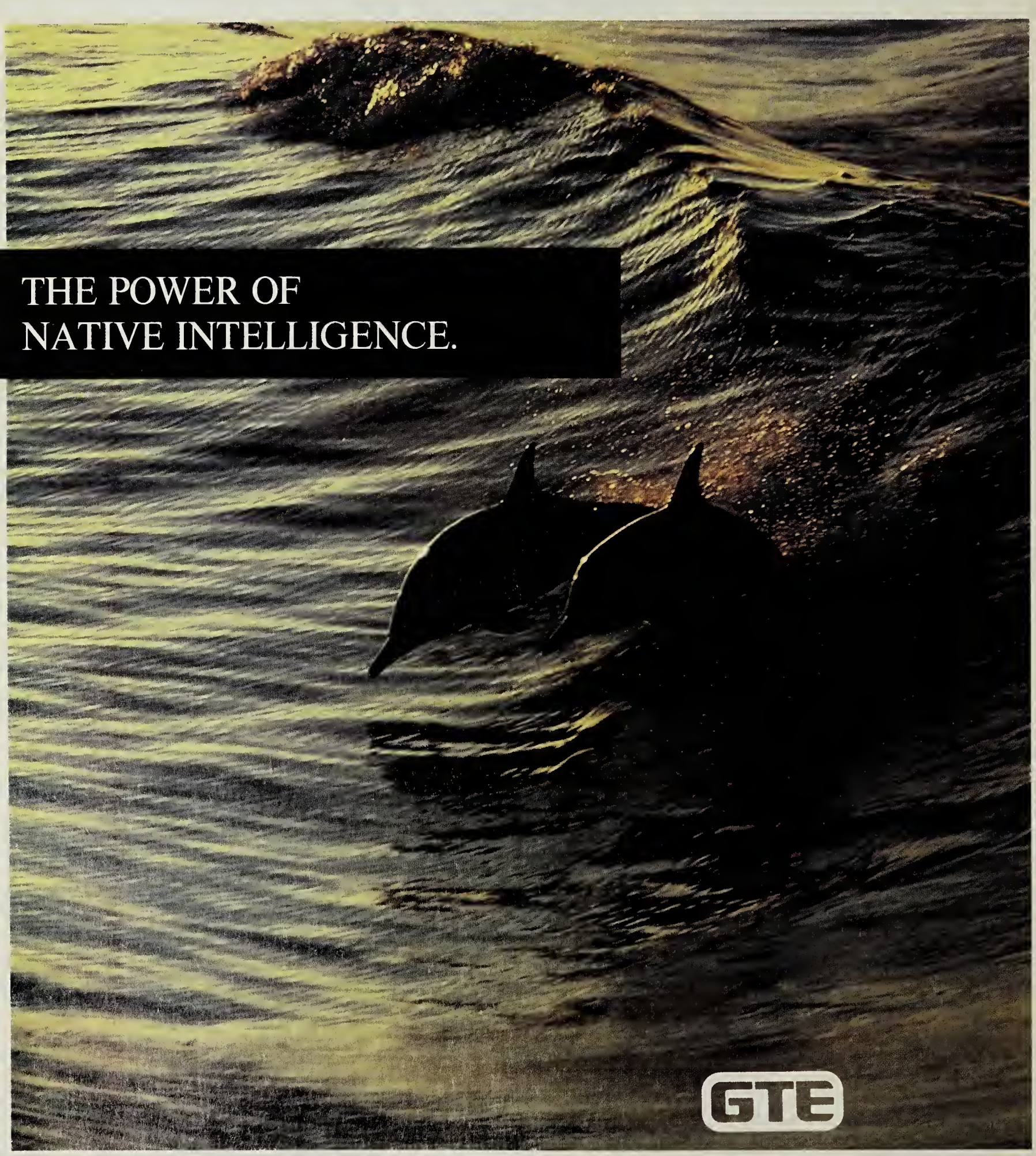
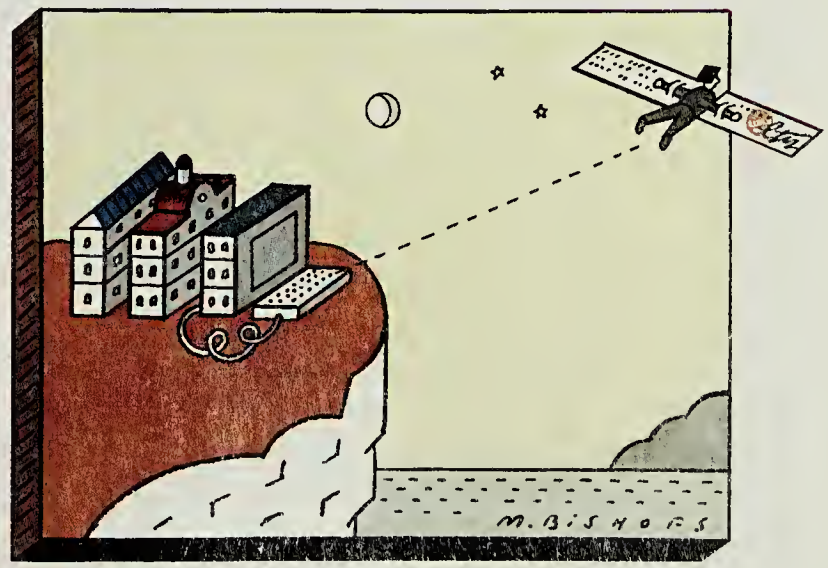


THE POWER IS ON

BY DAVID KELLY

THE FUN DOESN'T HAVE TO STOP WHEN THE PAYCHECKS START

If you're spending any time these days searching the back of your closet or the dark recesses under your bed for pieces of clothing that could pass as "corporate," then you've probably also confronted a few dark thoughts about exactly what kind of existence lies ahead.



You got into a computer science or electrical engineering program because of aptitude, of course, but also because creating software or building hardware was some of the best fun on the right side of the law. The question is, can computing still be fun when it becomes a way to make a living?

The answer is, yes, it can. Becoming a "professional" doesn't

---

DAVID KELLY IS A WALTHAM, MASS.-BASED CONSULTANT AND CONTRACT PROGRAMMER SPECIALIZING IN NEURAL NETWORKS AND SYSTEMS INTEGRATION.

ILLUSTRATIONS BY M. BISHOFS

have to mean leaving all the fun and challenge behind.

I've learned through my own experience and that of my colleagues that it is possible to be gainfully employed and still hang on to a lot of the excitement that drew you to computers in the first place. In fact, there are lots of ways to have this combination.

■ **Think small.** After graduating from Syracuse University in 1986 with a computer science degree, I chose the route of working for a small company.

Turned off by the formalities of big firms and programming for mainframes, I found myself working as a programmer at a Boston-area company that makes personal computer-based process control software. I was the 15th person hired.

Because the company was small, my work broadened beyond merely programming. I was assigned to be product manager of an important new product and was responsible for overseeing its final design, beta testing and release.

What I found at that firm is typical of small, growing businesses: You're not limited to your job description. Being involved in many aspects of the business made my job exciting and satisfying.

There can also be an added monetary bonus to working hard for a small company. It may pay off in future stock ownership and other financial rewards if the company is successful. While I didn't stay around long enough to see those kinds of benefits at my first job — I left after 1½ years, when the company had more than 90 employees — the company is doing well today, with worldwide sales of its products.

■ **Think big.** Working for a large company can also provide its share of excitement and interest, provided you find the right job at the right company.

Large companies are generally in the enviable position of being able to support a wide variety of opportunities and projects. At a large company, you may be able to take advantage of specialized technical training, travel to trade shows and conventions or become involved in more theoretical research.

Keep in mind, however, that corporations with many departments may have multiple personalities. Look beyond the company name and focus on an individual department or position. A job supporting an existing product will be much different from a job developing prototypes.

■ **Use your spare time to pursue your real interests.** Even after all this career building, you may find yourself in the wrong company or doing the wrong type of work. Don't despair. Work on what really interests you in your spare time, with the idea of making this specialty a full-time pursuit.

While working at Hewlett-Packard Co., Don Laabs followed his personal interest and developed a computer cribbage game in his spare time. Because no one was interested in it at HP, he sent his program to several game companies. Within a few weeks, The Software Toolworks, Inc., a Nevada, Calif., company that makes a

WILD CAT!

Richard Hooker is no work drone, and he doesn't believe his employees should be either. Hooker, who is president of Powersoft, a Duluth, Ga., company that sells an imaging product for PCs, hopes he can move enough software to buy a chimpanzee (current retail price: $25,000). Until then, he has to settle for raising his 12-pound, 2-month-old baby cougar, Thermo, in his house.

As his taste in pets shows, Hooker isn't a do-it-by-the-book kind of guy. Since starting two companies (Powersoft and Pinnacle Software, Inc., a consulting company) three years ago, he has worked hard to grow his businesses, but he has also worked hard at holding on to fun and creativity in the process.

Before starting his companies, Hooker worked as a computer programmer and manager at a microwave components firm. That company was a playful place — at least in the beginning. There was a Wednesday bowling league and volleyball and beer parties every Friday. Hooker found, however, that as the company grew (it went from 150 to more than 900 employees), some of that camaraderie was lost.

He set out to find some of that lost spirit and new challenges in ventures of his own.

While Hooker is all business with clients, he makes sure his firm stays relaxed. For example, he is planning a fishing trip to Florida for his eight-person staff. Hooker also sets up group dinners, lunches to discuss new projects, poker games and parties to keep the company atmosphere informal and stimulating.

HOOKER AND HIS CAT, THERMO

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number of popular Nintendo games, bought the game and hired Laabs. He is now vice president of software development and oversees various stages of new game development (see story below).

■ **Get out of the back room.** If troubleshooting and dealing with people appeals to you, consider a software or hardware support job. Such positions allow you to keep up technically but usually also require very well developed personal skills. Support jobs often allow you to interact with a wide variety of people and see interesting installations.

My friend Roger travels extensively throughout the U.S. supporting Unix cash register systems. He has been to all the major cities and almost every state, keeping on top of the latest developments in the Unix world. Roger says that while the traveling can be tough sometimes, it does have its rewards: He moonlights as a poet and guitarist and has accumulated enough frequent-flier miles to fly his five-member band from Boston to Los Angeles to play and record on the West Coast.

■ **Become a hired gun.** If making lots of money is your idea of fun, then contract programming may be the job for you. All types of companies use contract, or short-term, programmers to fill temporary needs. Contract programmers may be used to test a new software package before it's shipped, meet a critical deadline or fill a needed position for which the company can't hire a full-time employee for financial reasons.

Typically, companies look for specific knowledge in contractors. They expect them to be qualified and experienced. Assignments generally last three months to one year and may require travel or relocation.

Money is not the only drawing card for contract work, however. It can be a great learning experience. During the past two years, I have had contract assignments creating a design specification and prototype for a product upgrade, writing code for an experimental financial (credit assessment) program and installing computer networks.

Another advantage is that contract work is flexible by nature (you can work part time, take time off and make your own schedule) and offers you the free time to pursue outside interests. With the flexibility of my schedule, I have been able to complete two-thirds of my MBA in little over a year by taking off early two days a week and taking off full days near exams.

■ **Build your own.** If blue suits, a 9-to-5 workday, long lunches and corporate titles don't appeal to you, maybe what you really want to do is strike out on your own.

Mike, a programmer and risk taker I met at my first job, started a company just one year out of college. The company developed a small, answering machine-type device that distinguishes between incoming telephone calls and incoming faxes.

Working long hours, laboring over details such as how to get Federal Communications Commission approval for the device and finding a manufacturer were just some of the challenges Mike encountered.

HOBBY JACKPOT

Working for a games company isn't all entertainment, but Don Laabs, vice president of software development at The Software Toolworks, Inc., says a job like his is a great score for anyone who liked to play games as a kid.

Actually, Laabs wasn't looking for a job in May 1988 when he submitted a software version of cribbage to The Software Toolworks, a company famous for Nintendo and computer games.

It turned out that the company liked his game so much that it not only bought the rights and released it as Cribbage King/Gin King, but it also lured Laabs away from his job at Hewlett-Packard Co.

LAABS' GAMES PROGRAMMING STARTED AS A LARK AND TURNED INTO A CAREER

Laabs got into game creation during the years he worked as a software engineer on automated test systems at HP. He spent his free time developing multiplayer games for mainframes that he and fellow employees would play at lunchtime. When he saw what a good response those efforts received, he decided to see if he had what it took to succeed in the game industry.

As he has since discovered, the real challenge in this business is not in designing a game but in creating a set of features and a presentation. For example, he says, "The challenge isn't to design a chess game but to give it a certain look and to keep it exciting."

Laabs likes the direct response that programming on consumer-driven products provides. "My previous job was very removed from the end user. Now I can tell how well I am doing by how many people are walking into stores and buying the program I worked on," he says.

According to Laabs, not all programming jobs at the Nevada, Calif., company are filled by game nuts. Programmers need strong software design skills and the ability to program in C, although some games are created in Pascal or assembly.

"Games design is very similar to traditional programming. Games have become so large that their development takes many programmers," Laabs says. "We typically have a team of specialists working on each game: a memory management programmer, a low-level graphics programmer and an engine [or rules and moves] programmer."

While working for a software entertainment company can be fun and games, it can also be hard work. "The programming department has to work long hours when we have to get a product out," Laabs says. "It takes a lot of time and effort to develop a game."

PHOTO BY ANDY FREEBERG

He became involved in a lot more than programming, including finding contacts in the telephone industry to help design the product; managing development, testing and manufacturing; and investigating both U.S. and Canadian laws regarding safety and performance.

Completed a year ago, the product has yet to provide substantial cash rewards. Even so, Mike, who has since started another company that is developing software for computer fax cards, is upbeat about the experience.

"Even though it's a lot tougher than working at a regular job — the hours are longer, the rewards are sometimes fewer, and it tends to be more stressful" — running your own company brings its own kinds of compensation, Mike says. "I've learned an incredible amount that just can't be learned any way else." ■

WHAT'S AHEAD?

GORDON BELL

Chief Scientist
Stardent Computer, Inc.
Concord, Mass.

Career highlights: Spent 23 years at Digital Equipment Corp. in charge of R&D and was instrumental in the design of the DEC VAX family.

The price of hardware is heading to zero. Although this trend has placed enormous stress on companies such as IBM and Digital Equipment, the great part about it is that the large number of installed hardware platforms has created a huge software market.

Software is the area to be in these days. With many more powerful machines on which to run software, this will be a very exciting decade in terms of applications.

The area of mechanical engineering will be particularly exciting as we gain the ability to model systems and virtual reality, which will give the person the ability to be there, whether "there" is a galaxy or an atomic structure.

Unfortunately, the networking capability to carry that software is not where I'd like to see it. We need good networks with powerful bandwidth.

The technology already exists – it's just a matter of carriers realizing that there is a market for it.

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PHOTO BY ROBERT HOLMGREN

THE INS AND OUTS OF THE JOB MARKET

If you had an employment specialist next to you, what would you want to ask? Steve McMahan, managing director at the Boston office of Source EDP, a recruitment firm specializing in the placement of computer professionals, agreed to field questions from students and recent graduates for us. Hopefully, your answers are here:

WHAT TECHNOLOGIES ARE HOT IN THE JOB MARKET RIGHT NOW?

Rick Neff
Bachelor's degree, computer science
Virgina Military Institute
Lexington, Va.

TECHNOLOGIES ASSOCIATED with cooperative processing and workstation computing are hottest now, especially personal computer Windows and Sun Microsystems, Inc. Unix-based systems. Knowledge of C and object-oriented C++ are in demand, as are skills in SQL-based database management systems. Companies are also seeking experience in the Novell, Inc. Netware and Microsoft Corp. LAN Manager arena.

WHAT KIND OF INTERNAL AND EXTERNAL TRAINING SHOULD I EXPECT A POTENTIAL EMPLOYER TO PROVIDE?

Donna Sabovik
MBA program, concentration in MIS
University of Arizona
Tucson, Ariz.

THIS VARIES widely. Occasionally, major employers will offer three to six months of information systems training programs for new hires. But most training is limited in scope and is needs-specific. For example, many firms will offer in-house training or vendor courses related to the technology in use. In addition, most will offer training on in-house development methodologies.

That said, training budgets are under substantial pressure. Companies are primarily looking for candidates needing minimum training.

HOW CAN A STUDENT GO ABOUT FINDING SMALLER COMPANIES THAT DON'T HAVE THE RESOURCES TO PROMOTE THEMSELVES?

Mike Morford
Bachelor's degree, electrical engineering
Iowa State University
Ames, Iowa

START BY checking with your undergraduate placement center to learn of smaller firms that have recruited at your school in the past. Next, check your alumni directory for people who've found their way into these firms and see if they might know of any openings. Network through friends, parents of friends and family. Monitor local and national media closely. Also, look into local chapters of professional associations such as the Data Processing Managers Association, the Society for Information Management and the Association for Systems Management. Finally, check your local and state employment offices.

career ASSIST

WHAT LEVEL OF EDUCATIONAL DEGREE DOES ONE NEED TO ADVANCE IN THIS FIELD? IF THE ANSWER IS A MASTER'S, WHAT SHOULD IT BE IN — TECHNOLOGY OR MANAGEMENT?

Nicole Jordan
Bachelor's degree program, electrical engineering
State University of New York
Stony Brook, N.Y.

A BACHELOR'S degree is enough to get you started in all but the most elite firms. However, companies now often require master's level degrees for senior IS positions.

While there is no single magic combination, the best bet is to avoid redundancy. For instance, a technical undergraduate degree (in engineering or computer science or, if interested, business, finance or accounting) coupled with a business degree such as an MBA or vice versa is preferable to two degrees in computer science.

WHAT GEOGRAPHIC REGION IS UP AND COMING FOR COMPUTER SCIENCE GRADUATES?

Peter Tang
Bachelor's degree, computer science
City College of New York
New York

THE STRONGEST growth currently is in the Pacific Northwest, the Southeast and the Midwest. Traditional strongholds in the Northeast and California are currently in a down cycle. Keep in mind, however, that what is generally being measured when considering smaller and up-and-coming areas is relative growth. Thus, while Seattle may be growing rapidly, there are still relatively few technology companies there. ■

WHAT'S AHEAD?

ARNO A. PENZIAS

Vice President of Research
AT&T Bell Laboratories
Short Hills, N.J.

Career highlights: Known for his work in radio astronomy. Co-winner of the 1978 Nobel Prize for Physics for evidence supporting the Big Bang theory of the origin of the universe.

When we move to an era in which technology is truly integrated, we'll see a tremendous growth in sales just because people will be making money by using computers. By truly integrated I mean the ability for computers to play with one another and play with human beings.

This will require improved interfaces and networks, so we'll have to work on voice recognition and on developing software that supports networks.

There will always be jobs for nerds, but the real leadership positions will go to people who can integrate their own thinking into how the system plays with the world, not just put their noses down into the design and the code. The really good jobs will go to the specialists who can think generally.

When considering where you want to work, first thoughts are always of big name companies. But goals can change . . .

ILLUSTRATION BY RUSSELL O. JONES

Employment aspirations

BY KELLY E. DWYER

It starts somewhere around the time you begin to feel comfortable on campus and picks up as the semesters go by. Everyone, it seems, wants to know exactly what you intend to do with yourself after graduation.

If you are anything like the students who filled out survey cards in *Computerworld*'s 1990 Campus edition, a great many of you are thinking big — Big Blue, that is. IBM got 665 mentions from the 995 respondents to claim the distinction of No. 1 choice as a potential employer. This is not a new honor for IBM, which took first place in the previous year's poll as well.

In fact, there was very little change from 1989 to 1990 in the Top 10 picks. All the names remain the same, with nine out of 10 picks being vendors of some sort.

While the composition of the Top 10 remained consistent, their relative ranks did not. Digital Equipment Corp. and Microsoft Corp. traded places as DEC dropped from fourth to ninth, and Microsoft jumped from ninth to fourth. These students were evidently paying close attention to business page coverage of DEC's downsizings and Microsoft's growth curve. Intel Corp. bounced from 10th to sixth, and Andersen Consulting slid from the eighth spot to the 10th. IBM, AT&T, Hewlett-Packard Co., Apple Computer, Inc. and Motorola, Inc. held their places at first, second, third, fifth and seventh, respectively.

Curious about the preference for large vendor companies, we talked to a number of respondents to find out why they chose the companies they did. The most common response was, "I've heard of them."

Don Peterson, director of engineering placement at the University of Michigan in Ann Arbor, explains, "These are the companies they've heard most about, read most about and whose products they use."

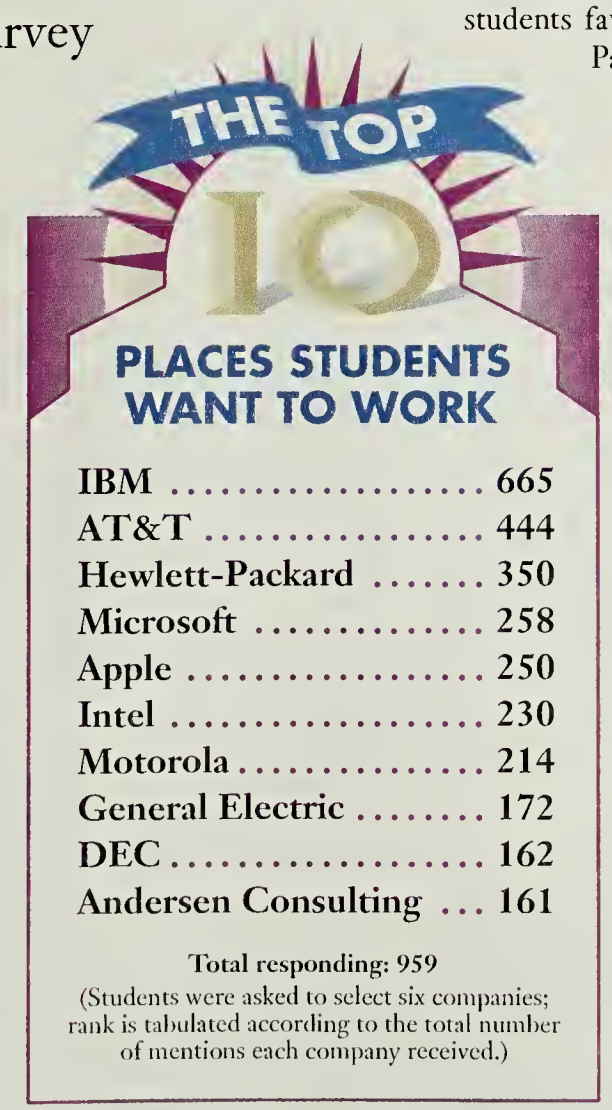
Name recognition is not the only reason why many students favor the industry giants, of course. Patrick M. Alphonso, a junior at the University of Michigan College of Engineering, has a number of arguments to support his selection of Microsoft, Apple, IBM and NEC Corp. as his favored employers. "I figured they not only had good salaries but good health benefits, too," he says.

Alphonso adds that large companies are attractive to him because they would allow him more flexibility to change his areas of interest.

In contacting respondents, we also discovered that many who initially chose large companies are now thinking considerably smaller, however.

Michael Marlow, a Michigan State University senior who expects to graduate in December with a degree in electrical engineering, says IBM was his first choice because he felt starting out with a job at a "name" firm would help his career down the road.

"It would be good as a first


THE TOP
10
PLACES STUDENTS WANT TO WORK
IBM 665
AT&T 444
Hewlett-Packard 350
Microsoft 258
Apple 250
Intel 230
Motorola 214
General Electric 172
DEC 162
Andersen Consulting ... 161
Total responding: 959
(Students were asked to select six companies; rank is tabulated according to the total number of mentions each company received.)

Source: *Computerworld* CW Chart: Marie Haines

KELLY E. DWYER IS A *COMPUTERWORLD* COPY EDITOR.

job because it's recognizable, and other companies would see that on my resume."

Marlow says he would still like to work at IBM, but recent events there have made him think that he might have to consider alternatives. "Looking at their economic situation, it looks like they're doing more laying off than hiring."

Intel, AT&T, Motorola, Texas Instruments, Inc. and HP were also on Marlow's list last year, "mostly because their main business is what my college degree is in." But now he says he's been scanning trade publications to find places to apply for jobs and sees more promise at smaller companies.

"In today's economy, it might be better to find a job in an up-and-coming company such as Intergraph Corp. or Micron Technology, Inc.," he says.

Phillip Rodas, who graduated from California State University at Fullerton last May and is searching for a job in the marketing/sales area, also says his strategy has changed a bit since last fall. If he could have his druthers, he'd still like to start out working at IBM, DEC or Xerox Corp. because of the kind of experience those companies could offer. But he says he can also see some real advantages to midsize companies with well-known products, such as On-Line Software International, Inc., AST Research, Inc. and Goal Systems International, Inc.

GO TO WHERE THE JOB IS

Marlow says he expects he'll have to relocate to get the kind of job he wants. "The economy is much better in other areas. In Michigan, it's horrible — the economy is terminally ill here." He says that urban areas such as Dallas are attractive because the large companies in the area, such as TI, tend to spawn a collateral industry based on spin-off companies.

Tracy Jackson's on-the-spot observations of the Dallas market bear out Marlow's suspicions. The recession does seem to be slacking off there, she says.

"I see a lot more ads in the Dallas area for entry-level work," Jackson notes.

Jackson, who graduated from Southern Methodist University in Dallas this past May, would like to find employment in Texas. Last year, she had her hopes set on Electronic Data Systems Corp., TI or American Airlines, but now she's not so sure those are either the most realistic or the best possibilities.

Competition for jobs at such companies is rough, Jackson says, and she has also begun to think that lesser known companies might offer more promise of growth outside the IS function.

Finding the perfect job at the perfect company would be great, the students we spoke with agree. But in a year of layoffs, budget cuts and corporate downsizing, most students, including those who have graduated and are still looking, are prepared to make the best of a job in their field at just about any company. ■

HIRE EDUCATION: USER FIRMS REVEAL PLANS

While only one user company made it into the students' Top 10 picks for places they'd like to work, such firms are an option for graduates. Here are the hiring outlooks for some of the nation's major user companies:

Amoco Corp.
Chicago
Thomas Farrington
Director, ISD management systems

■ Recruiting plans: We plan to maintain a strong presence on campuses. We've reduced our hiring goals compared with prior years, but there is still a recruitment budget for campuses.

■ Hiring profile: We'll be looking to hire programmer/analysts. Our entry-level jobs entail doing everything from basic programming on PCs and mainframes to more technical jobs. We look for computer science majors, MIS majors and business or math majors with some computer background. We want people who will learn quickly and apply what they've learned to solve problems.

Sears Technology Services, Inc.
Schaumburg, Ill.
Kevin Davis
Senior human resources representative

■ Recruiting plans: We currently have 40 to 45 positions available for data communications analysts, internal software programmers, network installers and network designers. Some positions are entry level, but we are looking primarily for experience.

■ Hiring profile: In addition to appropriate technical skills and experience, we look for good oral and written communication skills and the ability to translate technical terms and reports into language for people without a technical background.

Northwestern Mutual Life Insurance Co.
Milwaukee
Kathleen Elliott
Recruiting coordinator

■ Recruiting plans: This fall and next spring we will be looking for 40 full-time programmer/analysts. This job is entry level. Entry-level staffers go through training in PO1, our main language. Once trained, they will work on programming projects that include coding, testing and debugging instruction for computer programs in business systems.

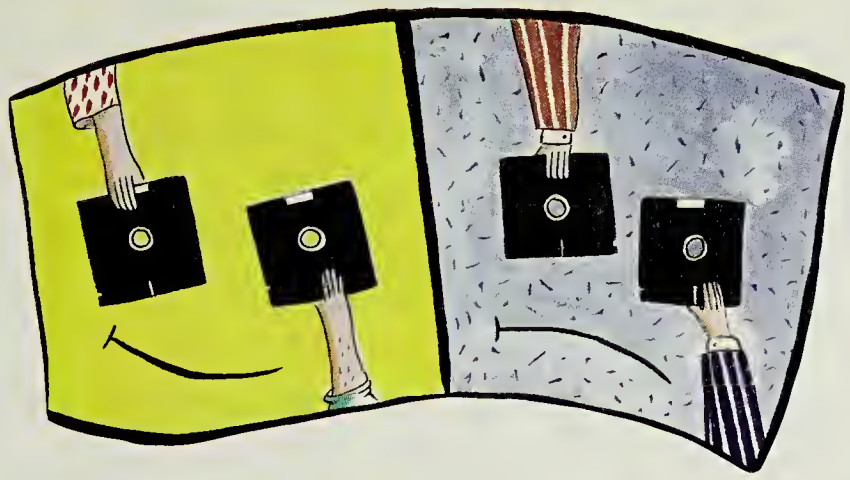
■ Hiring profile: A bachelor's degree in information systems is preferred, although we will also consider those with degrees in math, economics, insurance, finance or accounting or other business majors who have had several credits in data processing.

Mellon Bank Corp.
Pittsburgh
Julie D'Amico
Senior recruiter

■ Recruiting plans: We had 40 new recruits last year, and we hope to have about the same this year. These new recruits will be assistant programmer/analysts, which is an entry-level position. They must go through a 10-week training program. This training course involves learning Cobol, JCL, PSO and other languages.

■ Hiring profile: We are looking for students who majored in computer science, math or MIS and who have a 3.0 GPA or higher.

Compiled by Stefanie McCann, a Computerworld *assistant researcher.*



Hacking and software piracy are common on campus. But companies say unethical behavior isn't welcome in the workaday world

Assignment: ETHICS

BY DEREK SLATER

Here's a multiple choice question. Select only one answer:

You need a $395 spreadsheet for an important class. Do you: A) Buy the software for $395; B) Copy the software from a friend and spend the $395 on spring break; C) Copy the software because you just don't have $395.

If you selected B or C, you have a lot of company. Studies have shown that pirating commercial applications, along with hacking onto forbidden systems and other illegal uses of computers, is extremely common on campuses.

DEREK SLATER IS *COMPUTERWORLD*'S NEW PRODUCTS WRITER.

ILLUSTRATION BY M.E. COHEN

Graduating students heading out for interviews or the first day of work may want to leave homemade copies and telephone access codes behind, however.

Concern about legal vulnerabilities as well as the safety of their own data and that of their customers has made many employers wary about the computing practices of the people they hire.

MORE THAN HALF ***of the students responding to a study admitted using computers for 'unethical means'***

WHEN IN ROME

More than half of the students responding to a study at James Madison University in Harrisonburg, Va., admitted to using computers for "unethical means." Ironically, the highest number of offenders came from the information systems and computer science disciplines, where awareness of ethical issues was also greatest.

College students at other campuses confirm that both software piracy and illicit hacking are rampant. "Most students think it's OK because they're not the ones at risk," says Eduardo Castanon, a graduate student in human relations management at the University of Phoenix.

The high price tag on commercial applications is one justification students offer for their actions. Others are just not convinced that handing friends a useful piece of software or poking around on-line is so wrong. "There is this old academic value that information should be shared, that it should be a lot more open," says Deborah Johnson, a professor of philosophy at Rensselaer Polytechnic Institute in Troy, N.Y.

James Crossman, an undergraduate at Arizona State University in Tempe, explains that he sometimes copies university-owned software for the convenience of working at home.

"If I become proficient with a package now, I'm more likely to promote its use and purchase later at a company," Crossman says. He notes that software vendors recognize students' future influence on purchasing decisions by offering educational discounts. Also, Crossman says if the software is something he uses a lot, he'll buy it.

Students also get mixed signals from business and academic role models. According to James Madison professor Karen Forcht, faculty members on campuses often set the example in software piracy. "They won't do it with textbooks, but they'll turn right around and make copies of software," Forcht says.

David Chappell, MIS computing manager at the University of Arizona's Eller Graduate School of Management, says faculty violators are both blatant and unrepentant. "We've gotten faculty coming in from other schools who have 20 unlicensed programs on their hard disk. We won't support it, and they get upset," he says.

Similar practices are not unheard of in the business world. Robert Kaufman, a 32-year-old graduate student in applied mathematics at Wright State University in Dayton, Ohio, has spent 10 years working in architectural engineering. "Business is amoral," Kaufman says. "What managers say [about computer ethics] and what they do are two entirely different things."

SOMETHING IN THE AIR

However, that kind of tacit acceptance of software copying may soon become a thing of the past. Many companies are starting to get serious about the subject of software piracy.

One factor sparking the change of climate is fear of exposure and punishment: Illegal copies may result in large fines. High-profile raids carried out by the Software Publishers Association have many businesses scrambling to document which of their applications are properly licensed.

"We're very conscious of using only licensed copies," says David Johnson, a programmer/analyst at a major East Coast food distributor. "The raids have made us more aware of the seriousness of the issue."

Changing in the face of threatened fines and litigation may not seem like true ethical reform. However, some IS managers say that enforcement efforts have only heightened an existing concern.

"People have become more aware because of the raids, but I wouldn't say our basic attitude has changed," says Paul Summer, MIS supervisor at Owens-Corning Fiberglas Corp.'s Industrial Materials Group in Amarillo, Texas. Summer says his company owns a number of patents and copyrights and tries to honor those owned by others.

Albert Dammeyer, director of fulfillment services at Readers' Digest Association in Pleasantville, N.Y., concurs. "We have a company policy not to copy software, and we have an internal auditing group to make sure it doesn't happen. We've always been aware of our responsibilities as far as software goes."

Hacking is also coming under increased pressure from

Continued on page 34

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Continued from page 32

government activities such as Operation Sundevil, a federal and state task force investigating computer crimes.

"If students are planning a business career, they should realize that they can be fired or prosecuted in the business world for doing things that are tolerated in the learning environment," says Gail Thackeray, an Arizona prosecutor working on Sundevil.

A hacking background certainly raises questions about internal security for some IS managers. "If I interviewed someone and found out they were a hacker, I'd definitely recommend against hiring them," says a DP auditor at one Fortune 500 industrial company.

Even the campus may no longer be a safe haven for computer scofflaws. The long arm of enforcement is starting to reach into the academic environment. In August, the University of Oregon in Eugene settled with the SPA, agreeing to pay $130,000 for software copyright infringement. Furthermore, Forcht says, administrative tolerance is wearing thin. "We're going to see universities coming down harder on these things. It's no longer viewed as 'academic curiosity.'" ■

WHAT'S AHEAD?

RICHARD STALLMAN
Founder
Free Software Foundation
Cambridge, Mass.

Career highlights: Developed the Emacs editor and GNU operating system. Received the Grace Hopper Award from the Association of Computing Machinery for his work on Emacs.

I think the computer industry is headed into a morass of lawsuits that will make it almost impossible for any but the largest companies to continue to develop software. The reason lies in the existence of software patents. They cause every design decision in writing a program to carry the risk of a lawsuit.

There are thousands of software patents already. Each one covers an algorithm or a technique or a particular feature. To write a large program, you have to combine dozens or hundreds of techniques and features. Because each one of them probably will be patented if it isn't already, it's going to be very hard to write a program without infringing on patents.

Large companies may survive because they will own a large number of patents and can force everyone else to cross-license, but anyone who has the idea of starting a software company won't have a chance.

The only solution to this problem is for programmers and everyone concerned with computers to take political action to convince Congress to change the law.

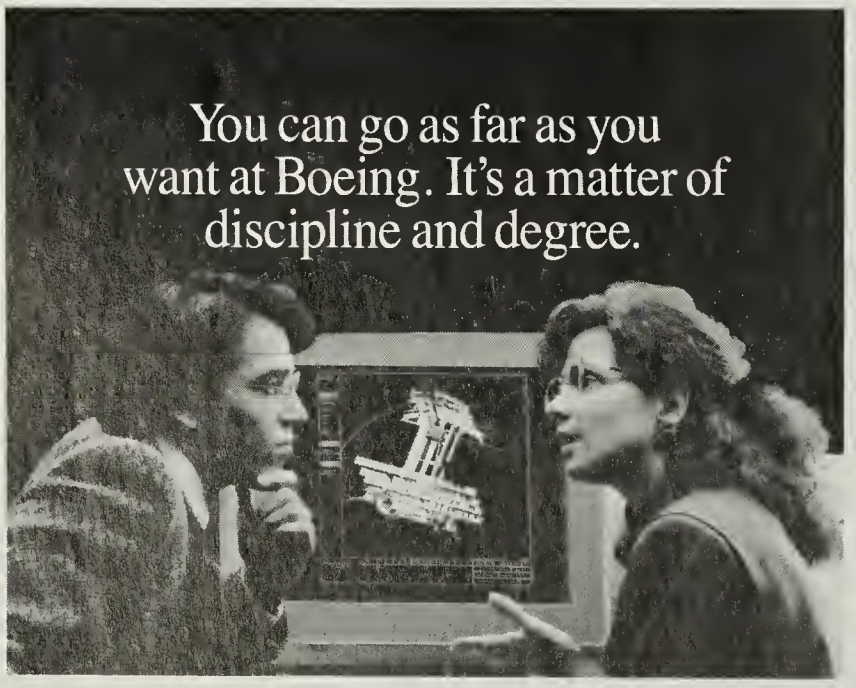

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PHOTO BY STEPHEN SHERMAN

Great jobs no one's heard of – *yet*

BY JEAN S. BOZMAN

Many of the computer-related jobs that will be most coveted a few years hence don't exist yet; at least, not in a formal sense. It takes a certain critical mass for a job classification to acquire a set description and a name, and these jobs are just starting to appear, propelled by new technologies and new application visions. Make no mistake, though; changes are afoot.

According to Paul Saffo, a research fellow at the Institute for the Future in Menlo Park, Calif., even trying to characterize what's coming is going to be tough.

"If you can define a job category, describe it and categorize it today, it probably won't exist in the 1990s," he says. The most important requirement for jobs that may emerge over the next few years will be the ability to learn, Saffo adds.

We managed to coax some industry observers and employment experts into describing new kinds of jobs they believe will soon emerge. Here's the gist of what they said (with titles that, we admit, are pure guesswork):

▶**Job title:** Superprogrammer.
▶**Job description:** Will create applications that can be used with little or no computer knowledge. Using complex C code or object-oriented programming tools, the superprogrammer will design easy-to-use workstation screens and windowing programs. These programmers will also push new features into electronic mail systems for the office and will make connections to far-flung databases a simple matter of clicking on a few icons.
▶**Skills:** C language programming expertise, in-depth knowledge of windowing technology and object-oriented programming and the ability to learn about new software tools as they become available.

JEAN S. BOZMAN IS *COMPUTERWORLD*'S WEST COAST SENIOR EDITOR.

ILLUSTRATIONS BY DAVID FLAHERTY

▶**Job title**: Software recycler.
▶**Job description**: Will concentrate on developing object sets and organizing reusable object-oriented routines into lending libraries for use by applications programmers who will weave specialized portions of programs around generic cores.
▶**Skills**: In-depth knowledge of object-oriented programming, database administration and software architecture/design will be required.

▶**Job title**: Roving programmer.
▶**Job description**: Using the latest in low-cost hardware, including lightweight personal computers, laptops and palmtops and sophisticated communications capabilities, roving programmers will get close to end users wherever they are, solve their immediate programming problems and move on. These highly mobile professionals will ply their trade throughout the organization, from headquarters to business units.
▶**Skills**: Knowledge of portable technology and sophisticated communications will be a must. Because coding to solve business problems on the fly will be a substantial part of this job, knowledge of at least two or three business-area functions, such as accounting, marketing or manufacturing, will be required. Roving programmers will have to know how to listen well, how to elicit business and systems requirements from users and how to respond to changing business needs. Quick studies will do well here.
▶**Comments**: Travel will be required.

▶**Job title**: Virtual reality designer.
▶**Job description**: Will create virtual reality simulation systems, combinations of software and bodyware that make the user part of the computer system. The ultimate in friendly user interfaces, virtual reality systems convert body motions into computer commands and allow users to interact on a real-time basis with an animated three-dimensional environment. Such systems are likely to be used extensively in training and design engineering.
▶**Skills**: Creating superrealistic graphics techniques that allow users to fly a fighter plane without leaving the ground, become an instant neurosurgeon or be shrunk as small as a blood cell for a tour of the cardiovascular system will call for familiarity with animation techniques, 3-D modeling and advanced programming for interactive systems. Some exposure to robotics and fascination with video games will also be helpful.

▶**Job title**: Network surveillance specialist.
▶**Job description**: The world of open networking is booby-trapped with security flaws, and your assignment will be to find those gaps and plug them.
▶**Skills**: In these days of enterprisewide networking, it will take the mind of a detective, the brains of a math whiz and the patience of a freshwater fisherman to secure networked computers. In addition to advanced skills in network security administration, network surveillance specialists

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will have to have knowledge of encryption techniques, access control devices and virus identification.

Considerable diplomacy will also be required because this job will often involve interacting with supplier and customer organizations whose systems intertwine with those of the employer.

▶**Job title:** Organic/cryogenic chip designer.
▶**Job description:** Will create chips using the latest in materials and techniques. Today's semiconductor chips are, for the most part, made of silicon. But tomorrow's will almost certainly be made of other, more challenging, materials — possibly including organic materials.
▶**Skills:** Will require familiarity with new materials, such as carbon-60 atoms shaped like soccer balls that can be arranged in layers one-thousandth the size of current chip components, as well as light-emitting silicon that is the basis for chips used in light-based optical computers.

Experience with making traditional silicon chips run faster using supercooled liquid nitrogen will be a must. Ideal candidate will be an electrical engineer with a background in both chemistry and crystallography.

▶**Job title:** Expertise conservationist.
▶**Job description:** As the oldest segment of the U.S. work force retires, it threatens to take its 30-year working experience home with it. The task of this on-staff consultant will be to capture large chunks of that knowledge in database banks that can be tapped by personal computers.

▶**Skills:** Knowledge of PC-based artificial intelligence and expert systems in the business environment will be a must. Candidates will need to have a range of functional area expertise and well-developed database creation skills.

They will have to elicit the right kind of information from experts and highly skilled employees and translate that information into AI-enhanced program modules that are capable of working within larger application systems.

▶**Comments:** This job is very similar to that of today's knowledge engineer. In the future, however, positions of this type will be regular components of the programming and/or database staffs at a large number of companies.

▶**Job title:** Lights-out engineer.
▶**Job description:** Will be responsible for overseeing the shift from manned to automated data centers and for maintaining these facilities once automation is complete. Must be able to design a near fail-safe facility, complete with sophisticated diagnostic and trouble-shooting tools, and oversee its continuous operation.
▶**Skills:** Will require experience in all phases of data center operations, knowledge of all types of systems and software for automated operations and the ability to integrate complex systems.

Self-starters and those who like working alone preferred. ■

WHAT'S AHEAD?

BILL GATES

Chairman and CEO
Microsoft Corp.
Bellevue, Wash.

Career highlights: Worked as a mainframe/minicomputer consultant in Seattle during high school. Co-developed a Basic language for the first commercially available microcomputer – the MITS Altair

The 1990s will be the decade of "information at your fingertips," or IAYF. This term embodies the concept of making computers more personal, making them indispensable, making them something you reach for naturally whenever you need any kind of information.

Fulfilling the idea of IAYF means we must go beyond thinking about computers only in terms of developing machines that are smaller and faster or about software applications only in terms of more and better features. We need to do a better job of thinking about technology from the point of view of individuals.

And we need to connect people to each other in a way that is as interactive and personal as a phone call but that can convey information much more dense and complex. Computers must be so interesting that people feel compelled to explore.

Getting to IAYF is going to be an evolutionary process. There are many pieces that must come together: portable hardware and pen computing, object orientation, Object Linking and Embedding, networks and distributed file systems and multimedia.

You should be able to carry PCs around and gather information no matter where you are. Information from anywhere in your company – from another network, from a mainframe from around the world – must be readily available. You should be able to produce documents involving a number of applications without any awareness that these applications are even being invoked.

Work group communications, which today largely consists of E-mail, will have to be broadened to act as a base for other group activities such as electronic use and distribution of forms.

The kinds of information that it is possible to deliver and the ways in which it can be delivered will also need to expand to include sound, text, graphics and live motion on the computer screen.

The movement to IAYF will bring about many opportunities for computer science students in areas such as systems software, distributed database systems and development environments.

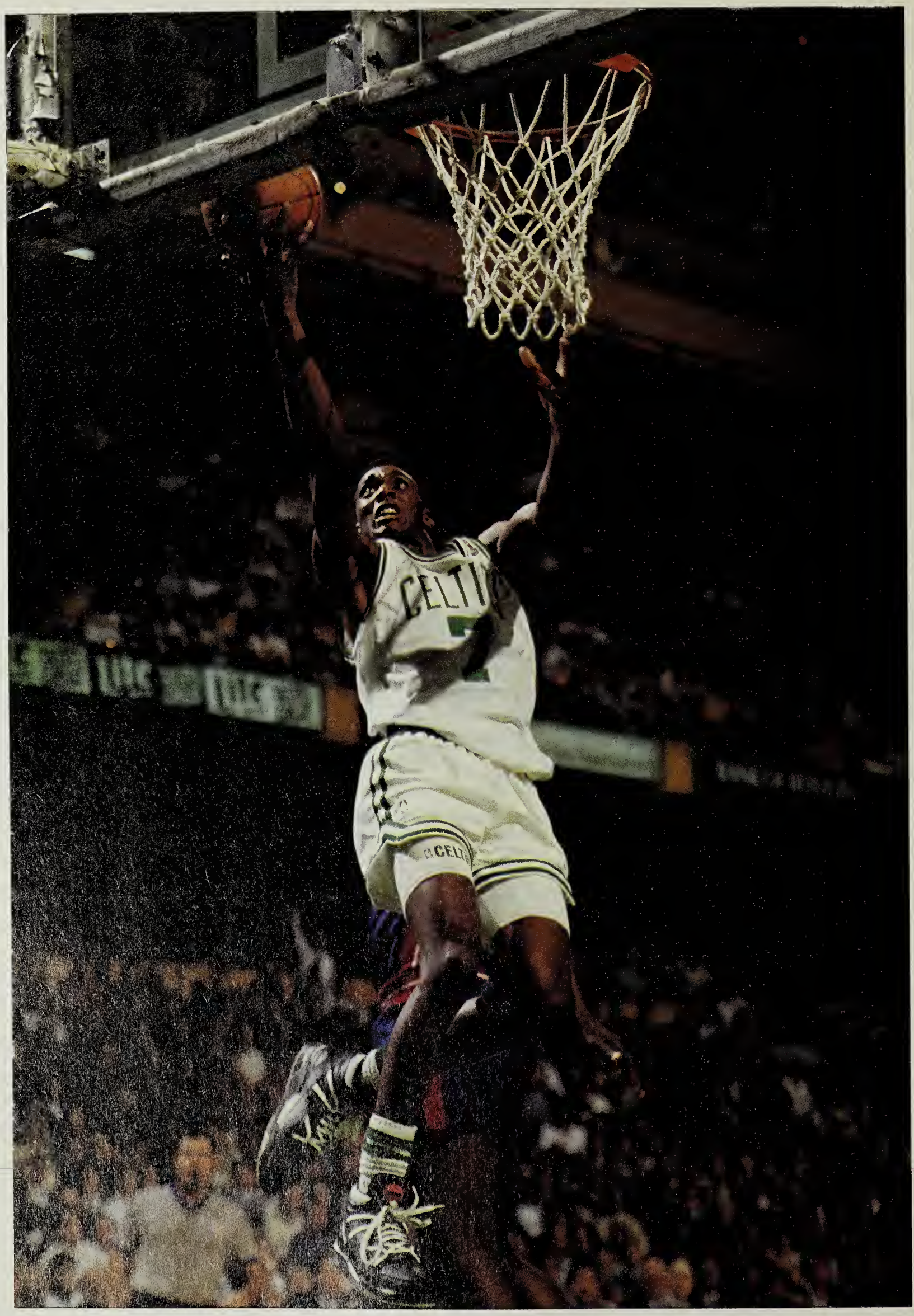

PHOTO BY STEVE LIPOFSKY

Dee Brown was only a few credits short of a career in computing when the Boston Celtics called

A funny thing happened on the way to the degree . . .

BY GLENN RIFKIN

If there is anything Boston Celtics guard Dee Brown loves almost as much as basketball, it is his computer. In fact, Brown took heat all of his rookie season with the Celtics for toting his Apple Computer, Inc. Macintosh portable along on road trips. "I used to get flak for being a computer nerd in high school and college, and I'm still getting it now," he says.

Brown, who got turned on to computers when he was 10 years old, was a computer science and math major at Jacksonville University in Florida. Now 22, he is two classes shy of his degree, but earning those credits will likely be put on hold for awhile because of his unexpected success in basketball.

The 6' 1" Brown was an unheralded college player and the 19th pick on the first round of the 1990 draft. But his impact in the National Basketball Association (NBA) was immediate and spectacular. He performed beyond anyone's expectations, walking away

GLENN RIFKIN IS A FREE-LANCE WRITER IN SUDBURY, MASS.

with the slam dunk contest at the 1990 All-Star game, leading the Celtics into the play-offs and being named to the All-Rookie team.

Although Brown's love of computers hasn't abated, his time at the keyboard has, simply because preparation for the basketball season is so demanding. "If I wasn't playing basketball, I'd definitely be working with computers," Brown says. "I had job offers in the computer business even in college, but I felt like I had to chase this dream."

BIG LEAGUE HOBBYIST

The dream, which undoubtedly will culminate in multimillion-dollar contracts and endorsements, will allow Brown to indulge in the latest and greatest hardware and software. He has been a computer shopper since the age of 11, when he saved up and bought an Adam computer, a now-defunct Coleco product.

Influenced by his mother's work as a computer analyst in the data center of a Jacksonville, Fla., bank, Brown grew up with the language of computers in his home. He taught himself how to program and didn't take a formal class in computing until he was in junior high school. By then, he'd purchased a modem, and he remembers "staying up 'til 2 or 3 in the morning hooking into bulletin boards."

> ***"IF I WASN'T playing basketball, I'd definitely be working with computers."***

In high school and college, Brown immersed himself in basketball and computers. "In college, while everybody was out partying, I'd be in my room at my computer," he says. "That was a good time to me."

The good times didn't include the *War Games* variety of hacking, Brown says, because he frowned on that kind of activity. But he smiles slyly and adds, "It was also because I didn't have the kind of hardware you needed. I mean, my modem was 300 baud. You couldn't do much hacking with that."

He claims to be proficient in programming languages such as Cobol, Turbo Pascal and C. Today, however, he focuses on the Macintosh, using a translation program called SoftPC to tie into the IBM Personal Computer environment.

During his college career, Brown kept the statistics of his Jacksonville basketball team on his PC, along with a database of all the opponents he faced. "I tracked their moves, their strengths and weaknesses, so I could use them the next time I faced them," he says. The information helped Brown earn his way onto the All Sun Belt Conference team his senior year.

Preoccupied with the intense grind of the NBA, Brown has not had a chance to update his database for the pros, but he said he plans to do that soon and hopes to convince his teammates of the value of the computer over simply watching videotapes. Brown is a realist, though. He knows it will be a long while before he persuades Larry Bird to log on. ■

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Experience preferred

BY CHARLES BURTON

Face it, companies like a little seasoning. Here's how you can get some

"How can I get experience when I need experience to get a job that will give me experience?" That's the catch-22, chicken-and-egg head scratcher that a lot of you are trying to solve right now.

This brainteaser does have an answer. In fact, it has several. If internships spring to mind, give yourself some points because potential employers will. The same goes for co-op jobs, campus research projects and summer or part-time jobs.

Some companies have always been inclined to favor applicants with practical experience, but now, many more are becoming selective in this regard, hiring fewer new grads and looking for a faster ramp-up from those they do hire. "My company could not afford to hire technical people without previous computer work experience," says Gary Fielland, a senior engineering fellow at Sequent Computer Systems, Inc., a company that makes on-line transaction processing systems in Beaverton, Ore.

Internships are just one way to get that

CHARLES BURTON IS A FREE-LANCE WRITER BASED IN JENKINTOWN, PA.

ILLUSTRATION BY RANDALL ENOS

much-needed experience on your resume, and they may even lead to a permanent position.

"An internship is like starting your job-hunting process early," says Chuck Olasky, a 1988 computer science graduate of the University of Texas at Austin, reflecting on his summer 1987 programming internship at Mobil Oil Corp., which now employs him as a senior programmer in Dallas. "I heard about the Mobil opportunity from my professors after [the company] came to make a presentation before the campus chapter of the Data Processing Management Association," Olasky says.

Even though the internship required some adjustments such as renting an apartment in Dallas for three months during the summer of his senior year, the data processing experience helped Olasky gain confidence, make money (he was earning slightly less than a starting salary for a full-time hire) and improve his marketability.

"Although I came back to campus with a job offer [from Mobil], I returned from my internship for campus interviews with other prospective employers during my senior year. The internship gives you a point of reference for questions and comparisons in weighing those offers," he says.

If you are willing to volunteer your services, there are also plenty of internship possibilities with worthy nonprofit organizations. One way to make such a connection is through a 5-year-old collective called Compumentor, which started in the San Francisco Bay area as a computer literacy program and now matches "mentors" possessing computer skills with hundreds of nonprofits seeking such assistance.

One cooperative Compumentor campus venture is built around a regional network that links organizations. It was designed by San Francisco State University students, who in turn act as mentors to individual organizations serving the homeless.

Ventures similar to Compumentor now exist in a number of cities and, in some cases, even have offices on campuses.

If you'd prefer to work without an intermediary, the central office of The United Way in Washington, D.C., and most of its

Continued on page 44

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EXPERIENCE PAYS: THREE HAPPY TALES

Three 1991 Syracuse University information studies graduates parlayed work experiences into attractive offers following graduation:

■ Virginian Larry Rose had the most unusual internship for a computer major. He combined two years of working with his dad, an independent computer consultant, with a White House internship in the Office of Public Liaison, where he worked on policy matters and implementing systems relating to special interest groups.

How did he land this plum assignment? By networking. "A friend worked there, and I called at a time when staffing levels were at an all-time low and a vacancy just occurred," he says.

Rose's experiences and resume caught the attention of numerous employers. Digital Equipment Corp. made him the best offer, and he's now in a two-year marketing training program with four six-month rotations through industry marketing. He says his networking, communication and marketing skills were improved by internship experiences.

Rose also used his semester off at the White House as the basis for two independent studies and internship credit — earning 12 academic credits.

■ Joe Larizza, Rose's classmate, had a resume that showed independent study in systems analysis, an internship at a Syracuse, N.Y., drug store chain where he helped to develop new automated auditing procedures and a couple of summer jobs setting up personal computers for small businesses.

Now an analyst at the investment banking firm J. P. Morgan & Co., Larizza says, "My work experiences while at college contributed to heightened analytical, listening and communication skills that were attractive to prospective employers."

■ Bret Costain packed his things and eight years of German language training to go off to work as an intern at Volkswagen AG in Wolfburg, Germany, for several months prior to graduation. Once there, he worked to develop competitive databases.

The experience taught him much about operating in a global context, thinking analytically in another language and using organizational skills in a big company environment.

Such skills helped him get his new job in the Securities Trust and Information Services Department at J. P. Morgan. He is currently working on a "secret project" related to client use of workstations.

Costain says he's happy about the route he took, especially in light of the fact that some of his friends who did not do internships are currently without jobs.

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COMPUTERWORLD

Newsweekly of IS

Continued from page 42
local affiliates publish directories of national nonprofit organizations to contact.

FLYING THE CO-OP

Cooperative education programs — in which you regularly alternate between work and the classroom, earning academic credits through practical experience — can also be an excellent direct route to postgraduation employment.

According to the National Commission for Cooperative Education (NCCE) in Boston, nearly 1,000 colleges and universities in the U.S. have co-op education programs in which more than 275,000 students participate. (The commission does not break out specific figures for schools with computer science and electrical engineering programs.)

Because co-ops are established arrangements between firms and colleges, participating firms often come to look at them as their best source of a continuing flow of new programmers and other computer professionals with predictable skills.

"By the time co-op students graduate from college, they've become pretty well involved with our different systems and programs. Almost all of them are offered a job," says Jan Moesch, assistant vice president of data processing training and compensation at Cigna Corp., which has set up multiple co-op programs with schools in the vicinity of its Hartford, Conn., and Philadelphia sites. In fact, about 80% of co-op participants receive a job offer from one of their co-op companies, the NCCE says.

If YOU ARE willing to volunteer, there are plenty of internship possibilities with worthy nonprofit organizations.

At Cigna, co-op students find jobs in all areas, from programming to training. The company's commitment to the effort allows flexibility on the part of students. Some work full time, others after classes.

Even though employers also look elsewhere for new talent, co-op students frequently have an advantage over other applicants because their familiarity with company policies and procedures means less training is required.

Susan Then, a 1990 Drexel University information systems graduate, worked as a programmer in a co-op position at AT&T in New Jersey, where she helped to develop a bill verification system for the company's Reach Out America program. Her experience won her a full-time post. "The co-op experience gave me a fast start compared to other new hires," she says, noting that she was exempted from a normally mandatory systems analyst training program for new employees.

Just because internships and co-ops are the best-known ways to obtain experience doesn't mean they're the only ways. University research projects in the computer sciences can also provide opportunities for work experience.

For example, Cary Phillips, who is pursuing a Ph.D., put his skills to the test as a University of Pennsylvania senior researcher and developer of an architecture that allows the use of human figure modeling in a three-dimensional environment.

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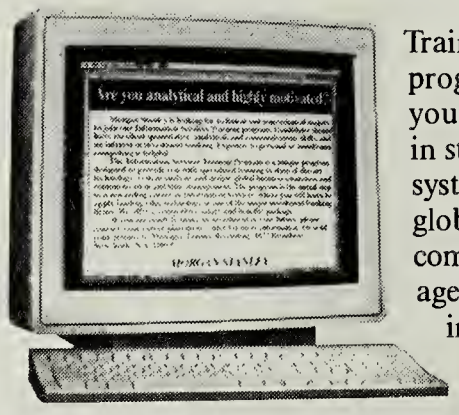

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Phillips' work at Penn centered on a system called Jack that enables organizations such as the National Aeronautics and Space Administration and John Deere & Co. to speed design and development.

In October, he'll move on to a job at Pacific Data Images, Inc., a company that has pioneered 3-D techniques.

Norman Badler, chairman of the computer science department at Penn, says opportunities like Phillips' aren't reserved for doctoral candidates and grad students.

"Our undergraduates are always encouraged to become involved in research projects that we have in the department, and occasionally, some undergraduates may work hourly for pay alongside graduate student supervisors," he says. ■

WHAT'S AHEAD?

ALAN KAY

Apple Fellow
Apple Computer, Inc.
Cupertino, Calif.

Career highlights: Best known for his pioneering work in personal computers, especially at the Xerox Palo Alto Research Center, where he conceived the idea for the Dynabook, a powerful lap-size computer.

The first revolution in the computer industry was from batch to time-sharing. The second revolution was from time-sharing to desktop computing. The third revolution will be from the desktop to what I like to call "intimate computing." Intimate computing will be enabled by portable computers that will probably weigh less than a pound and will act as communications devices.

In the next 10 years, we will have worldwide networks for data. Wireless transmission will be a big factor. Motorola, Inc. has proposed a bunch of low-flying satellites that you beam signals directly up to.

What this means for those of us designing user interfaces is that we can't believe the tool-based approach of the Macintosh or Windows is going to work. These help track a couple hundred things, but the new systems will have to track hundreds of millions of things.

We will have to switch from a tool-based interface to an agent-based interface. This will require a revamping of artificial intelligence from specialized little expert machines to systems that contain a broader range of knowledge.

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Ladder-vaulting champions: No rung-by-rung climb for these folks

BY WILLIAM BRANDEL

Mark Teflian had finished his second year of electrical engineering at Metropolitan State College near Denver in the summer of 1975. Convinced that he could probably do better for himself by heading into the work force, the 19-year-old convinced a friend who worked at United Airlines to get him an "in" to work on an ambitious computer project at the carrier's Denver headquarters.

"My friend said, 'Just give the kid a try and see how it works,' " Teflian recalls. At the time, United's information systems staff was not inclined to stand on ceremony. It was racing to develop and implement a large-scale automated ticketing system that the company hoped would give it a competitive edge as soon as deregulation of the airline industry became a reality. So Teflian, who was then studying calculator components, was given a part-time job working on what would become one of the largest on-line transaction processing (OLTP) systems in the world.

WILLIAM BRANDEL IS A FREE-LANCE WRITER BASED IN BOSTON.

"I didn't know what I was doing at the time," Teflian says, "but I looked at the problems I was presented with and solved them. So they asked me to come on full time."

Sixteen years later, Teflian is no longer part of United's IS department. He has been moved out and up to the presidency of Covia Technologies, a United Airlines spin-off that handles the implementation and support of the Apollo OLTP systems for airlines, ticketing agencies, manufacturers and other businesses.

Although going from part-timer to president of your own spin-off is an impressive leap in a little more than a decade and a half, Teflian's pace is not unique in an industry that thrives on change, innovation and competition. Because it is a relatively young and developing industry, the computer field has many opportunities for young, bright, ambitious people with open minds about where their career path will take them. Quite a few of the folks heading computer and software companies or directing technology strategy at large corporations today were using student IDs when Apple Computer, Inc. and IBM were bringing their first personal computers to market a little over 10 years ago.

Allow us to introduce you to just a few of the men and women in the computer profession who have risen quickly to the top. First, the rest of Teflian's story:

Mark Teflian, 35
President
Covia Technologies

It didn't take long for United Airlines to discover that the kid it had hired to help out was something more than an

COVIA'S TEFLIAN SAYS YOU HAVE TO MAKE YOUR OWN OPPORTUNITIES THROUGH HARD WORK

extra hand. Before much time had passed, Teflian had a reputation as a problem solver. It was Teflian, for example, who proposed that the airline use a scalable network management system based on microprocessors that could communicate via modem. Old hat today, but unheard of at the time.

A couple of things helped a lot, Teflian says. One was being in the right place at the right time. Because United's systems were being built from scratch, a rookie could work on equal technological footing with veteran computer people. Even professionals with 20 years' computer experience were learning the system and the new technology, he explains.

Equally important, his talented and experienced teammates on the project were generous with technical tips and guidance.

Between that initiation period and his current job, Teflian has moved from peon in the airline's IS ranks to manager of its functional operations to vice president and chief information officer of Covia Corp., Covia Technologies' parent company. Not bad for a person who never finished college, a decision he has never regretted. Teflian is proof that hard work and on-the-job experience are the stuff of advancement in the business world.

"A lot of people who came out of school in the '80s with an MBA thought they'd make $70,000 walking into a job," Teflian says. That, as he sees it, is no longer the case. Taking on jobs that others find unglamorous and making them work is what will get you noticed, he says.

"I was making up for my education deficiencies," Teflian says. "I just learned the applications by working too much, digging and staying up at night. And at the same time, I was learning the airline business. I never expected to be in this position today. I just wanted to be a supertechnician who was the best at his discipline, always staying current."

B. Michael Gerringer, 36
President, Mercantile Information Management Co.

Mike Gerringer isn't surprised at himself for doing so well, but he is a little surprised at his surroundings. "I always believed I would get this far in this amount of time," he says. "I just didn't know it would be right here."

The first step to achieving that "here" came in 1981, when, after three years of working at Rockwell International Corp. in Cedar Rapids, Iowa, initially as a programmer/analyst and then as a telecommunications project manager, Gerringer decided to go back to school.

Gerringer had a bachelor's degree in math and computer science from the University of Idaho, but he wanted to see how the business side worked, so he enrolled in the MBA program at Pepperdine University in Malibu, Calif.

In 1984, he got his chance to put that second degree to use. Security Pacific Automation Corp., Security Pacific Bank's IS subsidiary, was looking for a director of marketing for its telecom area. The firm found Gerringer working at Hughes Aircraft Co. in Los Angeles as a terminal systems manager.

From there, the path was a steady climb — leading from the marketing job to the post of chairman's executive assistant to division manager of back-office check processing and on to department manager of item processing.

"I had some really good mentors," Gerringer says, pointing to Security Pacific Automation Chairman John Singleton and Vice Chairman Bill Chenevich. "They encouraged me to make good career decisions, take risks and stretch."

So in June, when Gerringer was handed the opportunity to be president of Mercantile Bancorporation subsidiary Mercantile Information Management (MIM), he decided to take a

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MERCANTILE'S GERRINGER HAD AN APPETITE TO LEARN

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ERNST & YOUNG

Continued from page 47
risk. St. Louis-based MIM provides IS services to Mercantile Bancorporation, a bank-holding company.

His philosophy for how to get ahead is a simple one: "This industry seems to go well for those who have an appetite to learn."

James Chambers, 33
Vice president of IS
Nabisco Brands, Inc.

"My career's been a sampler pack; I've been sort of a utility infielder," James Chambers says.

He's not kidding. In the 10 years he has worked at Nabisco as a full-fledged employee (he was also employed there as an intern), Chambers has spent time in finance, marketing and sales. Now he's running IS.

He attributes his success to being able to take on a variety of challenges and learn from everything he has done. "Quite often, I'd get where there was no functional experience to be applied but I was needed to change the strategy. That's what I've been chasing for quite some time: new positions in the company where you don't have a standard job description but have a need to be fulfilled. For some crazy reason, they'd throw me into those."

NABISCO'S CHAMBERS SAYS HE DOES BEST IN JOBS THAT HAVE NO STANDARD DESCRIPTION

Chambers, who holds a BS in civil engineering from Princeton and an MBA from the University of Pennsylvania's Wharton School of Business, was tossed into the top IS job precisely because he'd proven his adaptability so often and because the company needed someone with a solid grasp of all facets of the business.

Chambers acknowledges that after leaving graduate school in 1981, he never anticipated his career taking him into the thick of the IS field. In fact, Chambers has never ventured far into textbook computer science, having taken only one course in the APL language in college. His business focus continued out of school at well, when he joined Nabisco as a cost/economic analyst and moved on to become senior director of drug/mass merchandising/convenience store sales and sales operations in 1986.

"The next time I had anything to do with a computer was in 1985," Chambers says. "I started working with a PC using a spreadsheet here at Nabisco."

At school, Chambers viewed computer science as an inward-focused, technical, specialized discipline. "I did not see at the time that it had a horizontal function that could affect large areas of the organization."

Although Chambers can now see quite clearly how IS can help various parts of the business and stitch together all those parts, he acknowledges that he's no expert at the nuts-and-bolts level. He concentrates on understanding the concepts and how systems work for the company.

"I get all the help I can get, asking [my staff] questions until their eyes roll back in their heads," Chambers says.

Kathy Davidson, under 40
IS vice president
Itel Rail Corp.

Davidson's career was heavily influenced by a chance conversation with an associate professor of accounting at her alma mater, Northern Illinois University. At the time, Davidson was an accounting major, and like any student, she wanted to leave school with the skills that would make her the most marketable.

ITEL RAIL'S DAVIDSON ATTRIBUTES HER SUCCESS TO BROADENING HER FUNCTIONAL SKILLS BASE

"He told me: 'If you want to be a good accountant, take as many computer science classes as possible,'" Davidson recalls. "So I did, and in the process I fell in love with computers."

Once hooked, Davidson didn't just dabble, she became an accounting/computer science double major. An internship at GTE Corp. as a Cobol programmer helped solidify her technical experience. Davidson says she felt that broadening her functional skill base has made her more valuable to companies.

"I've worn a lot of different hats," she says. "I have done everything from being a programmer/analyst to being in production operations to working in a development group to working on the strategic plans and budgets."

Davidson made her corporate debut in 1982 as a programmer/analyst at Ampex Corp., a tape company based in Redwood City, Calif., and then moved on to Itel Rail in 1984 as a systems engineer. It was here, at the staid and stable Itel that Davidson's business and IS experience met up with opportunity.

Tired of being in the technical/support area after three years with Itel, in 1987 Davidson asked to be transferred into the project-oriented systems development side of

PHOTO (LEFT) BY CLAUDIO EDINGER/GAMMALIAISON; (RIGHT) TOM ZIMBEROFF

the IS shop. "I told my boss, 'I want to manage by milestone, not by crisis," she says. By 1989, she had moved from systems manager to IS manager. Tapping into her business background, she took on responsibilities in the finance and administration areas. When Itel restructured its IS department in 1991, Davidson was a natural for the IS vice president slot.

Albert Wood, 38
Vice president of technological services
The New York Clearing House Association

Wood is an example of how to succeed by grabbing experience however and whenever you can.He has moved forward with hard work and ambition, as well as a little help from connections.

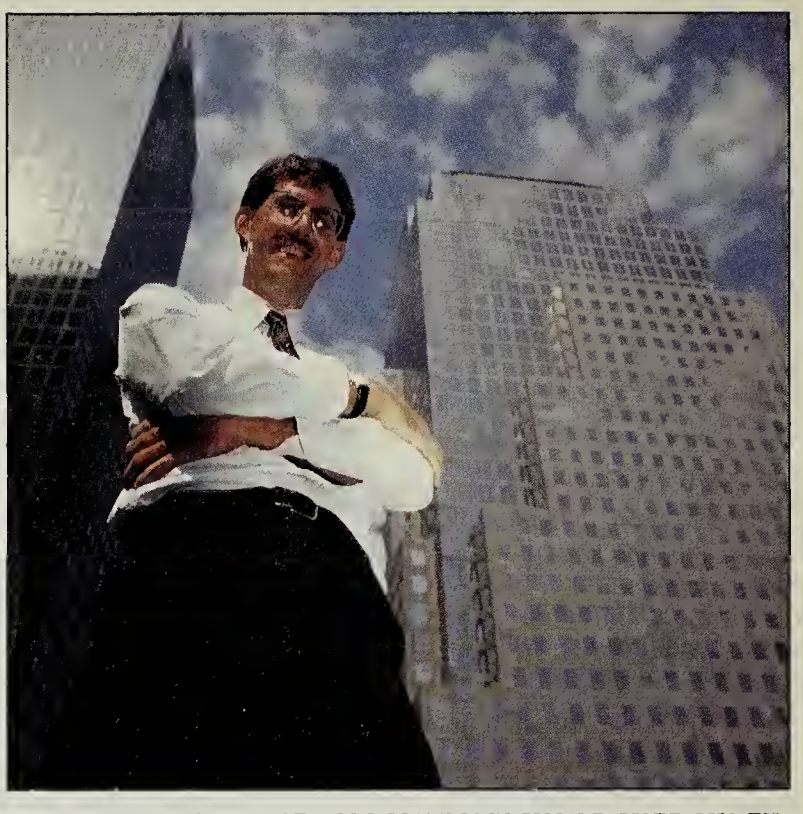
"After I left the C. W. Post campus of Long Island University in 1977 with my degree in information management, I couldn't find much work," Wood says. "I hit up a political connection and got a summer job with Suffolk County in New York" as a software programmer.

Suffolk County was converting from an old Burroughs Corp. mainframe to a new one. The skill he showed during that conversion ("They never had to bail me out. They liked that.") caught the eye of Burroughs District Systems Manager George Thomas, who hired Wood as a senior systems representative for Burroughs.

His first assignment? Finish the Suffolk County conversion job he helped start.

While at Burroughs, Wood got an abundance of experience. He gave sales presentations, installed systems, set up data communications networks, taught classes in-house and benchmarked systems.

Wood says working for a vendor brought him into contact with different technologies and enabled him to see the way these technologies were used in business.



THE CLEARING HOUSE ASSOCIATION'S WOOD USED HIS EXPERIENCE WITH VARIOUS TECHNOLOGIES TO GET AHEAD

In 1981, Wood moved again. Thomas was hired that year as senior vice president of data processing at The New York Clearing House Association to move its data processing system from lower Manhattan to midtown. He brought his multifaceted protege with him as manager of data communications.

"He asked me if I wanted a better job and to make more money," Wood says. "That's important, too."

At the Clearing House Association, he was initially in charge of setting up the data communications system. In 1983, he formed the organization's first support group and was given a staff to manage.

In 1990, Wood became vice president of technical services, overseeing all of the organization's IS operations except applications development. ■

WHAT'S AHEAD?

MICHAEL DELL

Chairman and CEO
Dell Computer Corp.
Austin, Texas

Career highlights: Founded his $546 million PC mail order and manufacturing company in 1984 when he was 19.

In the future, computers are going to enable a worldwide information democracy in which information is no longer reserved for large companies, the information systems department or the executive officer. Already, advances in technology, especially in the microprocessor area, are giving small companies the opportunity to do what was not possible five or 10 years ago. For example, they can cost-effectively replace manual operations or less powerful personal computers and run applications much more quickly.

We still have a way to go, however. User interfaces are one of the barriers to improved computing. Using a keyboard and little characters popping up on a screen is fairly inefficient.

In the short term, we will see more graphical user interfaces that can be accessed with point-and-shoot, mouselike devices. Eventually, we will be able to use video, sound and animation to record complete thoughts instead of tidbits.

Another barrier is networking. It is still easier to transmit information between companies via faxes than by computers.

Networking and PC software development are going to be hot areas in which to work in the future. Already, understanding how to apply distributed database technology is very important. But the most important thing to realize is that firms are looking for good businesspeople who also have IS skills.

The real need is to understand how the technical solutions are applied rather than just understanding the solutions. It's like the difference between a doctor and a pharmacist.

PHOTO (TOP) BY CLAUDIO EDINGER

The 100 best

The most effective corporate users of information technology (and how they got that way)

BY JOSEPH MAGLITTA & MICHAEL L. SULLIVAN-TRAINOR

Each year, *Computerworld* scrutinizes the top U.S. firms to find 100 that represent the epitome of effective technology utilization, its *Premier 100*. This is no beauty contest. Companies are carefully evaluated in terms of key indicators such as profit growth over a five-year period, information systems spending (not only absolute dollars but also how the money is earmarked) and the amount of investment in training for IS personnel.

This year, the selection process was further refined by breaking the 100 firms into lists of the 10 best firms within 10 industries, including a peer rating component in which the opinions of other firms in the industry were factored into the mix.

What makes these 100 companies so special are their methods of managing technology deployment. But this does not mean they follow a formula.

Nothing distinguishes this year's top crop of computing organizations more than the variety of recession-busting tactics that they are employing to make technology pay off.

For example, some companies boosted IS spending as much as 12% (**Bear, Stearns & Co., Bristol-Myers Squibb Co., Principal Mutual Life Insurance Co.**), while others (**Deere & Co.**) are slashing costs. Some are centralizing applications and operations (**Ameritech Corp., Sears, Roebuck and Co., The Hertz Corp.**), others are decentralizing (**Caterpillar, Inc.**), and some are doing both at once (**AT&T, Amoco Corp.**). Some winners are acquiring companies and combining data centers (**Banc One Corp., GTE Corp.**), while others are selling businesses and consolidating (**McDonnell Douglas Corp., Black & Decker Corp.**).

Nonetheless, a few generalizations suggest what makes *Premier 100* companies more effective than the average IS shop. For starters, most *Premier 100* firms are doing many things at once. Few have fallen into the trap of betting the business on The Big Project, the supersystem that will make competitive problems vanish in a puff of user-friendly smoke. A blend of technology, organization and business partnerships underlies most successful IS strategies.

Another element characterizing effective IS use boils down to what sounds like a classic management platitude: "Do the right things at the right time."

JOSEPH MAGLITTA AND MICHAEL L. SULLIVAN-TRAINOR ARE *COMPUTERWORLD* SENIOR EDITORS.

Companies in the 10 industries making up the Computerworld Premier 100 were asked to rank the Top 3 technologies critical to their success. Here's how their responses shook out:

1. **Local-area networks:** Of the 10 industry groups, only three — financial services, manufacturing and retail — failed to choose LANs as the No. 1 technology on their agendas.

2. **Imaging:** The three groups that didn't choose LANs to top their lists named imaging as their primary concern. In fact, imaging appeared on all 10 industry lists in one position or another.

3. **Expert systems:** While no industry chose expert systems as No. 1, it was ranked second or third by most industries except aerospace, pharmaceuticals and food and utilities.

Honorable mentions: Voice response, Integrated Services Digital Network and computer-aided software engineering.

What especially distinguishes *Premier 100* companies is a keen grasp of the simple (but critically important) notion that what's right for one company can be disastrous for another. Still, for most firms at this point, the right thing starts with a look at the economy.

MONEY ON THEIR MINDS

There's no doubt that the recession weighs heavily on many IS chiefs. In a telephone survey conducted in August by First Market Research in Austin, Texas, one-third of the 1991 *Premier 100* companies (most in aerospace and manufacturing) named "coping with changing economics" as their industry's biggest challenge.

Their concern is understandable: Continued downsizing and flattening, coupled with the recession, have made "doing more with less" a cliche in practically every IS organization.

Predictably, the biggest challenges facing IS departments were also seen as economic. Stretching IS dollars, finding new ways of doing things and making people more efficient was cited by 29% of firms as the top IS job for next year. More than one-third said the recession has resulted in deferred spending, cost reductions and budget cuts. Worst hit were petroleum, chemical and manufacturing companies.

The recession "has affected us rather dramatically," said Steve Hicks, data center director at **Clark Equipment Co.** "We're looking at the reduction of hardware. We won't eliminate hardware, but we probably will downgrade it. Then, you have to look at personnel."

Despite such pressures, IS budget cuts affected only 11 *Premier 100* companies, including half of the aerospace firms.

The 100 Most Effective Users of Information Systems

'91 Industry rank	Company, Top IS executive, Title	IS budget (millions)	1991 IS staff
Aerospace			
1	**The Baeing Ca.** Art Hitsman, President, Baeing Camputer Services	$1,3DD	13,SDD
2	**Narthrap Carp.** Herb Andersan, V.P. and General Manager	$28S	1,900
3	**Grumman Carp.** Gerald H. Sandler, President, Data Systems Divisian	$1S9	2,000
4	**Martin Marietta Carp.** Raymand S. Wiltshire, V.P.	$32D	2,2DD
5	**McDannell Dauglas Carp.** Ernie Ridenhaur, V.P.	$7DD	3,70D
6	**Lackheed Carp.** Dean D. Allen, V.P. and CID	$276	1,928
7	**Rackwell Internatianal Carp.** J. F. Sutter, V.P. and General Manager	$260	2,739
8	**Gencarp, Inc.*** Linda Gearge, Directar	$42	NA
9	**Raythean Ca.** Rabert 8. Almeida, Directar	$197	1,232
10	**United Technalagies Carp.*** Rabert Farte, Oirectar	$84D	NA
Consumer Products and Services			
1	**Helene Curtis Industries, Inc.** Tam Gildea, V.P.	$22	150
2	**The Hertz Carp.** Gary Orrell, Staff V.P.	$110	7DD
3	**Reader's Digest Assaciatian, Inc.** Kenneth A. Nelsan, V.P. and Oirectar	$98.9	1,D17
4	**Gillette Ca.*** Herbert Maller, Directar	$113	NA
5	**The Dun & Bradstreet Carp.*** Michael S. Field, President, Infarmatian Graup	$750	NA
6	**Tyca Labarataries, Inc.*** Lauis Chiesa, V.P.	$13	NA
7	**Alberta-Culver Ca.*** Rich Pulsen, V.P.	$7	NA
8	**Avan Praducts, Inc.*** Raymand Perry, CID	$37	NA
9	**Clarax Ca.*** Raymand Jahnsan, V.P.	$14	NA
10	**Humana, Inc.*** Fred Pirman, Seniar V.P.	$72	NA
Financial Services			
1	**Narthwestern Mutual Life Insurance Ca.** Edward A. Flitz, V.P.	$S1.2	S07
2	**Aetna Life & Casualty Co.** Jahn D. Laewenberg, Seniar V.P.	$6DD	4,9DD
3	**Massachusetts Mutual Life Insurance Co.** Jahn J. Pajak, Executive V.P.	$78.2	873
4	**Mellan Bank Carp.** Oavid A. Maare, Seniar V.P.	$193.6	1,511
5	**Primerica Carp.** Ed Sherin, Seniar V.P. and CIO	$232.2	1,424
6	**Principal Mutual Life Insurance Ca.** Rabert W. Delaney, V.P.	$64.0	741
7	**Bear, Stearns & Co.** W. Ben Kuenemann, Seniar Managing Directar	$99.S	421
8	**Metrapalitan Life Insurance Co.** Daniel J. Cavanagh, CID	$25D.0	2,584
9	**U.S. Bancarp, Inc.** Tim Meiar, Manager	$S2.4	439
10	**Banc One Carp.** Oavid Van Lear, President, Services Carp.	$258.0	1,45D

* Estimates are from *Computerworld* sources, not the company NA = Not available

The 100 Most Effective Users of Information Systems

'91 Industry rank	Company, Top IS executive, Title	IS budget (millions)	1991 IS staff
Industrial Products			
1	**Caterpillar, Inc.** Oale Fieldcamp, Carparate Oirectar	$3D0	2,800
2	**Deere & Ca.** Paul F. Dhman, V.P.	$189	1,400
3	**Paccar, Inc.*** Bruce Carlsan, General Manager	$71	NA
4	**The Timken Ca.*** Rabert Leibensterger, V.P.	$37	NA
5	**Clark Equipment Co.*** Faster Martin, Oirectar	$28	NA
6	**Black & Decker Carp.** Sidney Diamand, V.P.	$85	65D
7	**Dresser Industries, Inc.*** Henry Paulsen, Oirectar	$112	NA
8	**Greot Amer. Mgmt. & Invt., Inc.*** Michael J. Carcaran, Manager	$46	NA
9	**York Haldings Carp.*** Drville N. Trembly, Directar	$30	NA
10	**Harnischfeger Industries, Inc.*** Sean Bradley, Directar	$27	NA
Manufacturing			
1	**3M Co.** Carl A. Kuhrmeyer, V.P. and CIO	$400	3,200
2	**Mead Carp.*** John Langenbahn, V.P.	$S6	NA
3	**Eastman Kadak Co.** Katherine M. Hudsan, V.P. and Carparate Oirectar	$S00	3,500
4	**General Electric Co.*** Edward Skika, V.P.	$1,029	NA
5	**Lafarge Carp.*** Brian Pawell, Oirectar	$1S	NA
6	**Loral Carp.*** Hazeljean Adams, Manager	$16	NA
7	**Temple-Inland, Inc.*** James Thamas, Directar	$27	NA
8	**Boise Cascade Carp.** James E. Harder, Directar	$8D	$11
9	**Polaroid Corp.** A. L.. Hyland, Oirectar	$64	4S0
10	**Inland Steel Industries, Inc.** William Howard, V.P.	$69	496
Petroleum and Chemicals			
1	**Amaca Carp.** Jahn R. Reid, V.P.	$312	2,319
2	**Unacal Carp.** Paul R. Janes III, Carparate Directar	$141	375
3	**Daw Chemical Co.** Oanald S. Pirkle, V.P.	$36B	2,2D0
4	**Phillips Petraleum Ca.** P. J. Gattardi, Manager	$203	1,411
5	**Freeport-McMaRan, Inc.** Ran P. Landry, Oirectar	$15	78
6	**Air Praducts & Chemicals, Inc.** Peter W. C. Mather, V.P.	$51	388
7	**Chevran Carp.*** William Bartz, Manager	$182	NA
8	**B. F. Gaadrich Co.*** Matthew J. Battista, V.P.	$25	NA
9	**USX Carp.*** Richard Rabinsan, Manager	$177	NA
10	**Atlantic Richfield Ca.** Jahn Caman, Manager	$236	1,683

* Estimates are from *Computerworld* sources, not the company NA = Not available

Reductions were scattered evenly among deferred capital investments, delayed hardware and software purchases and job freezes. Tougher times have also prompted many companies to ensure they are getting the most out of what they've already got.

At Black & Decker, for instance, Sidney Diamond, vice president of worldwide information services, said that while the firm uses many new technologies, "I don't think it is critical. There may be some mature, developed technologies that can do the job. PCs aren't new, for instance, but they may be used in some new ways."

Metropolitan Life Insurance Co. is a good example of a company that has tightened ship in several ways. In recent months, the $29 billion New York insurer has recentralized research and development projects, cut back on the use of outside consultants, frozen hiring and increased the use of videoconferencing to cut down on travel costs. Staff training has also been stepped up.

Yet in many cases, *Premier 100* winners said they will be doing more with *more*. Nearly 60% got budget increases for 1991-1992, including 90% of transportation companies. (In 1990, 53% got increases.) Roughly two-thirds of the extra money has been slated for hardware and software, the rest of it divided between IS staff and training.

By industry, utilities spent an average of 4.2% of revenue on IS, followed by transportation (3.9%) and aerospace (3.7%). At the low end was retailing (0.9%) followed by petroleum and chemicals (1.3%).

Next to budget gainers, the second-largest group included those with flat or "zero-based" budgets. One-third of *Premier 100* companies fell into this category, compared with 21% a year earlier, including 70% of petroleum and chemical firms. In such companies, new or unanticipated projects may be funded on a project-to-project basis.

Interestingly, almost one-fifth of companies said that the recession had no effect at all on their information systems. Good long-term budgeting was credited with shielding them from the blows.

"We have been very conservative in our budgeting," explained Carl A. Kuhrmeyer, vice president of administration and chief information officer at **3M Co.** "We have very stringent hiring controls. Any staff reductions resulting from lower 1991 earnings will be handled through attrition."

Regardless of whether budgets have risen or fallen, recession in many cases has whetted appetites for technology. Almost three-fourths of the firms (and all retailers) said that during the next 12 months, they would install systems to provide competitive advantage. This total is up from last year's poll, in which about two-thirds answered yes.

Dave Kaufman, director of IS at **Pepsico, Inc.**, was among the true believers. "The biggest advantage is having instantaneous information on the effectiveness of your promotions in the marketplace so that you can adjust what you're doing according to people's reaction," he said. "If you can get that information quicker, you have the advantage."

Merck & Co. has been exploring the use of electronic imaging systems to create a sterile vaccine manufacturing plant by employing three-dimensional modeling to

The 100 Most Effective Users of Information Systems

'91 Industry rank	Company, Top IS executive, Title	IS budget (millions)	1991 IS staff
Pharmaceuticals and Food			
1	**Merck & Co.** Bill Pater, Executive Director	$210	1,100
2	**Bristol-Myers Squibb Co.** Alex J. Gibbons, Corporate Director	$195	1,547
3	**Pfizer, Inc.*** William Mullin, V.P.	$20	290
4	**Eli Lilly and Co.*** Lee Gery, Director	$42	NA
5	**Becton, Dickinson & Co.** Roland Cyr, V.P.	$50	448
6	**Upjohn Co.*** Susan Barber, Director	$53	NA
7	**Johnson & Johnson*** Paul DeMarco, Supervisor	$215	NA
8	**Schering-Plough Corp.*** Don Longston, Director	$40	NA
9	**Abbott Laboratories*** Kenneth Farmer, V.P.	$159	NA
10	**Pepsico, Inc.** Allon B. Deering, V.P.	$265	1,000
Retailing			
1	**Sears, Roebuck and Co.** Charles A. Carlson, President, Technology Services	$1,172	6,238
2	**Wal-Mart Stores, Inc.*** Robert L. Martin, Senior V.P.	$326	NA
3	**Kmart Corp.** David M. Carlson, Senior V.P.	$216	1,757
4	**Service Merchandise Co.*** Jack Cose, Senior V.P.	$26	NA
5	**Food Lion, Inc.*** A. Edward Benner Jr., V.P.	$44	NA
6	**Dillard Department Stores, Inc.*** Malcolm Ritchie, V.P.	$28	NA
7	**Giant Food, Inc.*** Robert Schaening, Senior V.P.	$23	NA
8	**Price Co.*** Marci L. Knight, V.P.	$48	NA
9	**Toys R Us, Inc.*** Dennis Healey, V.P.	$48	NA
10	**JC Penney Co.** David V. Evans, V.P. and Director	$171	1,600

* Estimates are from *Computerworld* sources, not the company NA = Not available

The 100 Most Effective Users of Information Systems

'91 Industry rank	Company, Top IS executive, Title	IS budget (millions)	1991 IS staff
Transportation			
1	**Airborne Freight Corp.** David A. Billings, V.P.	$52	330
2	**AMR Corp.** Max D. Hopper, Senior V.P.	$998	6,006
3	**Delta Air Lines *** Ron Eubanks, Director	$189	NA
4	**Union Pacific Corp.*** John Monning, Director	$200	NA
5	**Alaska Air Group, Inc.*** Leif Haslund, Assistant V.P.	$40	NA
6	**Unigroup, Inc.*** Bill Troutman, Manager	$27	NA
7	**Federal Express Corp.** Ron J. Pander, Senior V.P.	$234	2,012
8	**Worldcorp, Inc.*** Clarence Johnson, Director	$12	NA
9	**Burlington Northern, Inc.*** Robert M. Brydges, Assistant V.P.	$242	NA
10	**Roadway Services, Inc.** Jon T. Pavloff, V.P.	$80	524
Utilities			
1	**MCI Communications Corp.** James L. Zucca Jr., Senior V.P.	$440	1,800
2	**Bell Atlantic Corp.** Joseph T. Ambrozy, V.P.	$669	3,453
3	**AT&T** W.F. Osl Jr., V.P.	$2,800	18,000
4	**Ameritech Corp.** Glen Arnold, V.P.	$954	4,955
5	**GTE Corp.*** Joseph Rasmussen, Director	$800	NA
6	**Southwestern Bell Corp.*** Ghyrane A. Davidson, V.P.	$300	NA
7	**Pacificorp** Radney M. Baucher, CIO	$74	515
8	**Northeast Utilities** Tad O. Dixon, V.P.	$73	406
9	**Carolina Power & Light Co.*** R. Thomas Dwyer, V.P.	$46	NA
10	**Long Island Lighting Co.*** William Dimaulos, V.P.	$23	NA

* Estimates are from *Computerworld* sources, not the company NA = Not available

help design vaccines for acquired immune deficiency syndrome and other diseases.

While individual industry needs differ, imaging systems, local-area networks and expert systems were seen as the most important emerging technologies (see chart page 53).

Improved customer service, understanding business systems and architectures, more user control and involvement as well as accessibility to information and good technical support were mentioned frequently as contributors to IS success.

But the factors cited most often by *Premier 100* winners have nothing to do with technology. Forty percent said "teamwork" and "management support" were real make-or-break elements in a technology effort.

"Teamwork is important," affirmed Alex Gibbons, corporate director of MIS at Bristol-Myers Squibb. "Decisions can't be made in a vacuum." Companies have been doing more than talking, too.

American Airlines, for example, has started a program called "Commitment To Leadership," which includes IS. The goal is to push decisions down to the lowest possible level, explained Brian Fornear, director of client services at **AMR Corp.**, American's parent company. And at **Northwestern Mutual Life Insurance Co.**, the vice president of applications sits on the company's marketing strategy committee.

This kind of teamwork makes good sense, Gibbons said. "It results in cost savings, management efficiencies and more features for more people."

Several other characteristics are typical of information technology use at *Premier 100* companies:

■ High interest in re-engineering. The idea of rethinking business processes using IS is hot. In fact, re-engineering was identified by 47% of respondents as the "single biggest challenge" facing IS in the coming year.

While more people are talking than doing right now, it's clear that many — especially retailing, manufacturing and consumer products companies — will take the re-engineering plunge. A whopping 92% of respondents said it was "very likely" or "somewhat likely" that their organization would re-engineer a business process during the next 12 months.

■ Downsizing of mainframe applications. Gloomy economics has quickened interest in shifting applications from mainframes to networked smaller systems. **Worldcorp, Inc.**, for example, traded an IBM mainframe for Unix-based workstations from Sun Microsystems, Inc. Projected savings are $1.5 million. **General Electric Co.**'s aerospace unit recently began migrating to a client/server Unix network based on Sun workstations.

■ Movement to open systems and networks. Closely related to downsizing is a strong push by many organizations away from closed systems and toward open communications links.

A few examples are as follows: Caterpillar added 100 nodes to worldwide networks. **JC Penney Co.** is testing the use of Integrated Services Digital Networks to link LANs at Penney stores. **Federal Express Corp.** embarked on a 3½-year project to shift its Cosmos worldwide tracking system over to a Unix-based distributed system. In total, 67% of companies said they are likely to roll out nonproprietary systems during the next year.

■ Customer service focus. Some 21% of *Premier 100* winners considered creating systems to improve customer service the most important task facing them. In consumer products and diversified services, the figure rises to 64%.

"Our buyers want to deal with decision makers," explained Tom Gildea, vice president of business information systems at **Helene Curtis Industries, Inc.** The personal care company equips its sales force with laptop computers that can perform on-the-spot analysis and other services for customers.

■ Global expansion. While worldwide recession has slowed global expansion, it hasn't stopped it entirely. Approximately 62% of *Premier 100* firms said they would expand overseas in 1991 and 1992.

Eastman Kodak Co., for example, is stretching its Open Systems Interconnect backbone to link two new overseas data centers to its Rochester, N.Y., headquarters. **Gillette Co.** is continuing a 2½-year project to connect operations in the U.S., Canada and Europe. 3M is expanding its highly successful 3Mnet beyond the U.S. and Europe to Japan. ■

TRENDS '91

Here's how *Premier 100* companies said things were going in a number of critical areas (telephone survey, August 1991).

■ End-user spending on the rise. As more firms decentralize, technology spending by end-user departments continues to climb. Sixty percent of companies expected the amount users spend on computers and networks to increase during the next year. The biggest jumps were predicted for food and pharmaceutical companies, as well as for financial services. Lowest: utilities.

■ Use of commercial integrators steady. Fifty-five percent will use a commercial systems integrator during the next year; 35% will not. Heaviest interest came from industrial, utility, petroleum and chemical companies. Least likely to use were financial services.

■ Consolidation slows. A hot issue last year, this trend has cooled, probably because many companies are well along in reorganization plans. Fifty-five percent considered it unlikely that they would consolidate data centers this year. Still, 41% said it's "very likely" or "somewhat likely." Aerospace and utilities firms voiced the most interest; industrial products and manufacturing companies expressed the least.

■ Security programs grow. Eighty-one percent of companies said it's likely they will implement data security measures during the next 12 months. Top choice: new security tools or features (39%).

■ Measurement programs wane. Sixty-five percent of firms have programs in place to measure the effectiveness of their IS operations. This compares with nearly 75% in 1990.

■ Maintenance and application backlogs still stuck. Thirty-one percent of firms expected their maintenance work to increase over the next year, 24% to decrease and 44% to stay about the same. Figures were similar for application backlogs: 29% expected the situation to improve, 27% to worsen and 41% to stay about the same.

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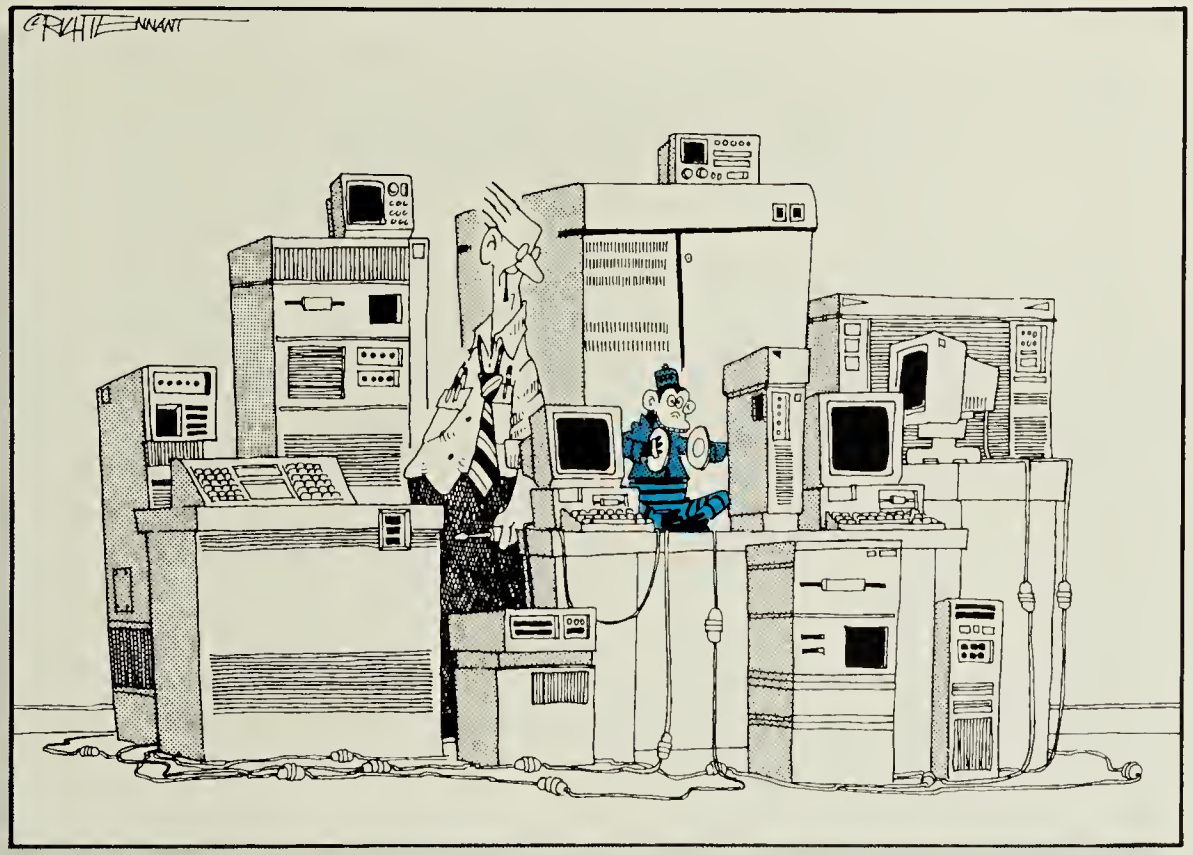

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Relative deprivation

Growth in IS salaries fails to keep pace with other professions

BY ALAN J. RYAN

Ouch! Information systems professionals are being pinched hard by the economy, according to *Computerworld*'s 1991 Salary Survey of Information Systems Professionals. Not only have IS salaries risen just 3.3% over last year's levels, but they also have not kept pace with those of other professions, in which the average pay increase for 1991 was more than 5%.

To add insult to injury, additional cash incentives are also on the decline, and 11% of the companies polled have salary freezes in effect.

Joseph Rich, principal at the Boston high-technology practice of Deerfield, Ill.-based William M. Mercer, Inc., says one reason IS salaries are not keeping pace with other professions is that some of the most IS-intensive industries are among the hardest hit economically. Mergers and consolidations, which have put many IS staff members out of work, are not really benefiting the survivors. Pared-down staffs are inheriting extra work but are not receiving big hikes in compensation.

In fact, indications are that a growing number of IS professionals are experiencing downward mobility — taking jobs at a lower title and salary level, says Jay Gaines, placement specialist at high-level IS executive placement firm Jay Gaines & Co. in New York.

Still, the news is not all bad. Gaines says IS salaries at the largest companies are still very attractive. The highly visible top IS jobs at large firms are still paying well above the $200,000 level. "And if the job is on Wall Street," he adds, "the numbers for the CIO start around $500,000."

Wall Street isn't the only land of plenty for IS executives, Gaines notes. Compensation also remains generous within the vendor community — large computer hardware and software firms, systems integrators and outsourcing firms — and much of the IS salary growth this year will occur in those firms.

Local-area network managers and administrators working in computer-related companies recorded salaries (about $62,188 annually) that surpassed those of peers working in other industries, including the traditionally well-paying fields of utilities and banking industries.

Telecommunications specialists are not only sought and rewarded by computer industry firms, however. According to Peter Tamblyn, senior consultant at New York-based compensation consulting firm Edward Perlin

Hot titles for high salaries

While many IS jobs have barely kept up with the rate of inflation, pay rates for some positions have jumped nearly 25% over the last five years

	Average salaries		5-year increase
	1987	1991	
Micro manager, end-user computing	$37,333	$46,397	24.2%
Systems analyst	$32,447	$39,548	21.9%
Senior programmer/Analyst	$35,678	$42,246	18.4%
Programmer/Analyst	$27,892	$34,675	24.3%
Operating systems programmer	$33,573	$40,454	20.5%

CW Chart: Janell Genovese

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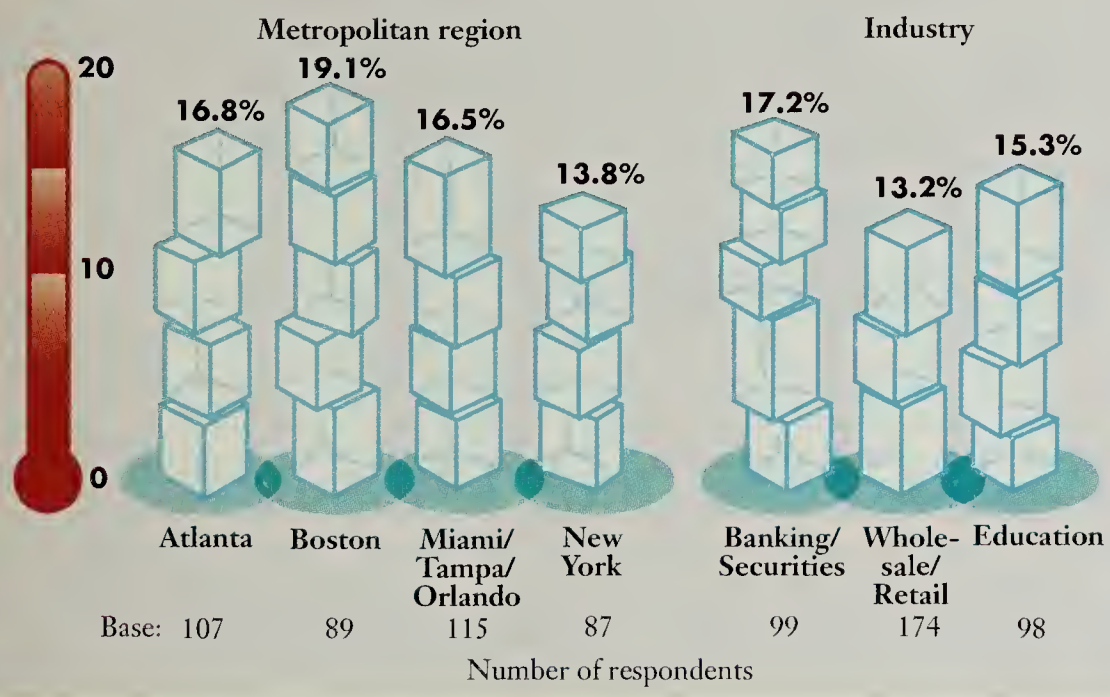
Cold climates for IS

Nearly 11% of all companies polled have a salary freeze in effect. Eastern seaboard cities and banking, education and retail industries have been hardest hit.



CW Chart: Janell Genovese

Associates, Inc., telecommunications specialists are particularly vital to companies such as investment firms that depend on wire transfers, manufacturers pursuing automated inventory control, banks and most hospitality providers.

Geography can also make a difference. Regionally, New York remains the most lucrative work locale for IS professionals. A typical CIO in the Big Apple earns more than $94,000 annually and rakes in another $11,000 in cash incentives.

Why so? Theories abound. Rich attributes it to the hassles involved with working there. "For all jobs, New York has a higher cost of labor than it has a cost of living — New York has combat pay," he says.

But Norm Sanders, managing director of Norm Sanders Associates, Inc. in Hazlet, N.J., offers another explanation. The greater New York area is home to many corporate headquarters. "They have to pay for the talent that can respond to the critical needs of the business."

However, not all of the money in IS is found at the biggest firms. Tamblyn notes that "Sometimes, small companies have to be aggressive payers because they have to compete" for the talent.

Other findings of the *Computerworld* study include the following:

- Communications professionals — network managers/administrators, telecommunications managers and communications specialists in the mining and construction field — outearn their counterparts by as much as $25,000.
- Education continues to hold the dubious distinction of offering the lowest pay for nearly all IS jobs. An example: While an IS manager/supervisor in the banking and securities field typically will earn about $75,000 this year, the same title in the education field will pull in just under $51,000.
- Microcomputer managers and end-user computing managers are the only titles in the study to have taken a drop in pay for 1991, from $47,601 in 1990 to $46,397 this year.
- The lowest paying IS job in the survey is that of a programmer in the field of wholesale/retail. That position pays an average of $25,698 in 1991.
- Boston topped the list of places to avoid because it has the highest incidence of IS salary freezes in the country, according to the study. A full 19% of the respondents from the Beantown area say they currently have a salary freeze in effect. ■

Little extras get smaller

The recession is taking its toll on average bonuses and other nonsalary cash compensation for IS professionals in general

IS title	1991	1990
PC specialist/Technical support	$991	$1,451
Network manager or administrator	$2,439	$2,702
Programmer/Analyst	$1,060	$1,306
Senior programmer	$1,168	$1,105
Programmer	$789	$1,125
Operating systems programmer	$720	$1,301
Data center or operations manager	$2,050	$2,005
Database manager or administrator	$2,547	$2,193

CW Chart: Michael Siggins

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Challenge me!

IS professionals say their companies aren't making full use of their talents, and if they leave, it will most likely be for opportunity, not money

BY ALAN J. RYAN

Information systems professionals say their organizations are working them hard, but they aren't being used to best advantage.

Computerworld recently polled 851 senior and middle IS managers and professionals for its fifth annual Job Satisfaction Survey. This year, the survey was expanded to include a number of questions dealing with job performance and how it relates to job satisfaction. Exploration of that connection produced some very interesting responses.

Consider, for example, that although six out of 10 respondents said stress levels in their organizations are increasing, only a small fraction said they felt their departments were performing up to full potential, and two-thirds of the sample said they didn't believe they were working up to their personal potential.

In other words, although they may be working under more pressure, many IS professionals are convinced they aren't doing the kind of work they could and should be doing.

These are not the complaints of frustrated top executives dealing with laggard staffs. Although managers expressed some discontent with departmental performance, they were actually milder in their criticism than nonmanagerial professionals. In rating their department's performance on a scale of 1 to 5, with 5 indicating optimal performance, 64% of the top IS executives surveyed rated their department's performance level at 4. Only 47% of middle managers and just 40% of IS professionals gave their departments a rating of 4.

Similarly, the feeling of personal underutilization was strongest among nonmanagers, with 70% of them saying that they were not working to their fullest potential.

Rajeev Bajaj, a senior programmer analyst at Maritz, Inc. in St. Louis, expresses some of the frustration behind the survey numbers.

"Given the knowledge I was exposed to in school, working in IS has been somewhat of a comedown," Bajaj says. There is often a "resistance to change toward more productive ways, toward more productive tools to do the job better and faster or in a more structured way.

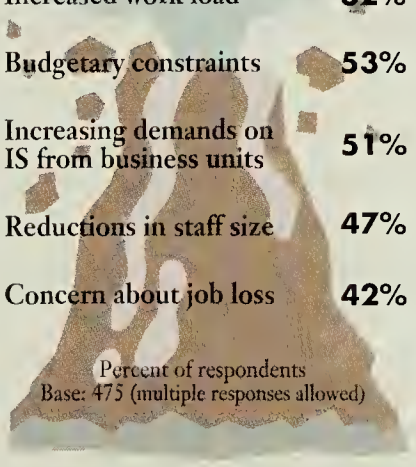
"That means that while we have the potential to change things . . . we are often not able to or encouraged to," Bajaj adds.

Slashed budgets, outdated tools and departmental cutbacks can all add to the frustration. At Stryker Corp. in Kalamazoo, Mich., corporate MIS Director David Huisjen says that sometimes, IS workers feel they are not working to their fullest potential because they either don't have the tools they need or because there is a communication deficiency between those who do the work and the long-range planners.

Although three out of four people surveyed agreed that there is a strong tie between job satisfaction

More work, more stress in IS jobs

Fifty-seven percent of those polled in Computerworld*'s fifth annual job satisfaction survey say stress levels have risen since last year. Here's why:*


Increased work load 82%
Budgetary constraints 53%
Increasing demands on IS from business units 51%
Reductions in staff size 47%
Concern about job loss 42%
Percent of respondents
Base: 475 (multiple responses allowed)

CW Chart: Janell Genovese

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and job performance, the factors that were cited as most important for each were quite different, depending on whether the respondent was a senior executive, middle manager or professional.

For instance, IS middle managers said they see the quality of work tools (48%) and relationship with managers (47%) as having a strong positive impact on performance within IS but cited salary (57%), relationship with manager (55%) and opportunity for advancement (53%) as factors that impact job satisfaction.

Meanwhile, IS professionals said availability of training (53%) and quality of work tools (60%) were the strongest factors affecting job performance, while job satisfaction was most apt to be affected by salary (61%), opportunity for advancement (57%), relationship with manager (57%) and flexible work hours (52%).

Interestingly, survey respondents at all title levels agreed that monetary recognition such as bonuses and salary increases, although important to worker satisfaction, have only a somewhat positive impact on job performance.

Sometimes, the best motivator is simply to express appreciation for your staff through gestures that show flexibility and awareness of their hard work, says H. Jay Stephens, manager of computer technology support at the Davis County Schools technology support organization in Farmington, Utah.

"One of the best things I find is to be a little bit lax in the summertime," Stephens says. Occasionally, he explains, he and his 12-member staff will head out for a morning of recreation when work is slow. "Just nine holes of golf and then back to work."

Recreation breaks may be particularly appreciated this year because more IS workers say they are feeling the effects of stress.

Middle managers seem to be hardest hit. Sixty-one percent of them reported an increase in stress within their IS departments since last year, compared with 49% of senior executives and 56% of IS professionals.

"The more you give people in this business, the more they want," Stephens says. "That's what causes your stress. They want it more and faster." The problem with stress, he adds, is that there are no simple ways to alleviate it in the IS field. "If I knew how, I would be putting it to good use," he says.

Other often-mentioned stress inducers include reductions in staff size (47%), increased work load (82%), budgetary constraints (53%) and increasing demands on IS from business units (51%).

Perhaps because of these kinds of pressures, nearly one out of three IS professional-level workers said the job satisfaction in their company's IS department is declining.

Dick Bodine, an IS director-level worker in Logan, Utah, says that in the electronic components industry, the impact of the recession has been strong, causing his IS department to cut jobs. That's frustrating, he says, because while there are things his department could do to help the company along, there simply aren't enough bodies left to make them happen and there's less money to train the ones who remain.

"I'm limited by budgetary constraints and backlog requirements," he says.

Although many IS professionals said they might consider leaving their current jobs for the right offer, few said they are interested in changing professions.

Ninety-two percent report that they are satisfied with their decision to pursue a career in IS.

Working in IS is certainly challenging, but it is a challenge that most IS workers welcome, Stryker's Huisjen says. "We are all masochistic in this business," he notes. "Stress comes with the territory." ■

Satisfaction does impact performance

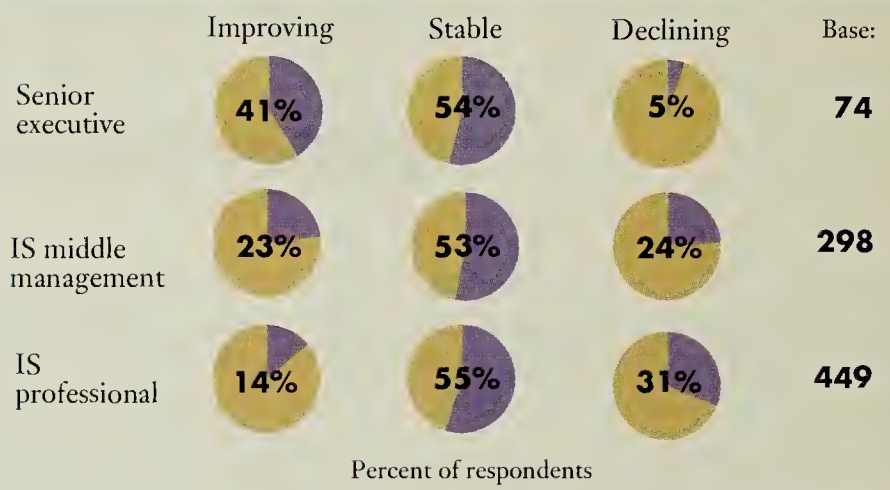
IS executives, middle management and professionals agree that when workers enjoy their work, they are more likely to work better . . .

"The more satisfied an employee is with his job, the better his performance."

Strongly agree	Somewhat agree	No opinion	Somewhat disagree
76%	**22%**	**1%**	**1%**

But consensus among the three levels begins to break down when it comes to assessing trends in job satisfaction.

"Describe the level of job satisfaction in your company's IS department."



Where levels meet

Although IS executives and professionals don't always agree on what satisfies a staff, they do agree on what makes one perform

Top satisfaction factors

What IS professionals feel influences satisfaction of an IS staff:

- Salary
- Opportunities for advancement
- Flexible work hours

What senior executives feel influences satisfaction of an IS staff:

- Salary
- Relationship with manager
- Feedback from supervisors

Top performance factors

IS professionals and executives agree on the top factors influencing an IS staff's performance:

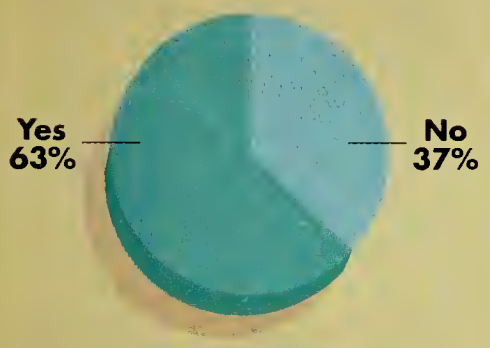
- Quality of work tools
- Availability of training
- Feedback from supervisors

Back to the books

A majority of the 910 undergraduate students surveyed by Computerworld Campus Edition *in 1990 said they were going on to graduate school for technical study*

Are you planning to attend graduate school in the next two years?

Percentage of respondents



If yes, what type of degree will you pursue?

Percentage of respondents

(Base: 546; multiple responses allowed)

"Everyone wants to write a compiler, but the real opportunities in the computer industry are in business applications rather than in inventing new tools."

Richard A. Pick, *President*
Pick Systems, Irvine, Calif.

CAMPUS TRIVIA

1. Dartmouth College is famous for many computer firsts. Of the following three pioneering milestones, which did not take place at Dartmouth: the first remote computer linkup, the first AI workshop or the first color video terminal?

2. John Von Neumann is a well-known pioneer in the computer field. In what area did he receive his first college degree? Was it chemical engineering, electrical engineering or mechanical engineering?

3. A book entitled *Who Got Einstein's Office?* is about a college institution where a lot of early computer research was done. Name the institution.

4. Some computers have become so famous in computer lore that many people know where they were developed. Can you match machines with their college birthplaces from the lists below?

Harvard University •	• Atanasoff
Iowa State College •	• Mark I
Moore School (Philadelphia) •	• Colossus
Bletchley Park (England) •	• ILLIAC
The University of Illinois •	• ENIAC

Answers: 1) The first color video terminal 2) Chemical engineering 3) Institute for Advanced Study at Princeton 4) Harvard/Mark I; Iowa/Atanasoff; Moore/ENIAC; Bletchley/Colossus; Illinois/ILLIAC

LOG OFF

High testosterone count

Nine percent of U.S. women enter high school with an interest in math and science. By the time they enter college, this percentage drops by a third. Only 2% actually earn related undergraduate degrees, and the odds of any U.S. female receiving a Ph.D. in math or science are just 1 in 1,000.

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Drexel University in Philadelphia has found a unique way to make its pitch to prospective students. At career fairs, college shoppers can use Drexel's interactive computer program to get a glimpse of what the university offers in such areas as academics, student life, career options and financial aid. The disk, which runs on any IBM PC or compatible with basic graphics capabilities, also allows prospects to file for admission by returning the application residing on the disk.

Sources: Adapso; The Computer Museum, Boston

WHAT'S AHEAD?

THERESE MEYERS

President and Co-founder
Quarterdeek Office Systems
Santa Monica, Calif.

Career highlights: Previously vice president of product development at Axxa Corp., a Citicorp subsidiary. Received the 1991 Ernst & Young Entrepreneur of the Year Award for the state of California.

The computer industry is going in two directions. One is to very powerful desktop workstations with extraordinary graphics capabilities. The other is to smaller, more powerful and inexpensive laptop computers you can take with you. Tying these together will be networked communications, which will allow the laptop computer user to take advantage of the graphics residing on the more powerful workstation.

To get to this point, hardware will evolve into higher capacity disk drives, which are smaller and lighter. There will be more advanced networks. Also, software developers will be working on products with the assumption that they will be used on a network rather than as stand-alone applications. Products will be designed with the idea of how a whole group of people relate to the program, not just one person.

The hot areas to work in will be graphics and networking. I'm a heavy believer in X Window System, a graphical windows environment [provided by a consortium under the direction of MIT]. It is designed so users can do remote computing – use a laptop machine with limited power and hook into powerful graphics capabilities on the workstation.

The key is that not everyone needs a powerful computer. They just need to be networked to one.

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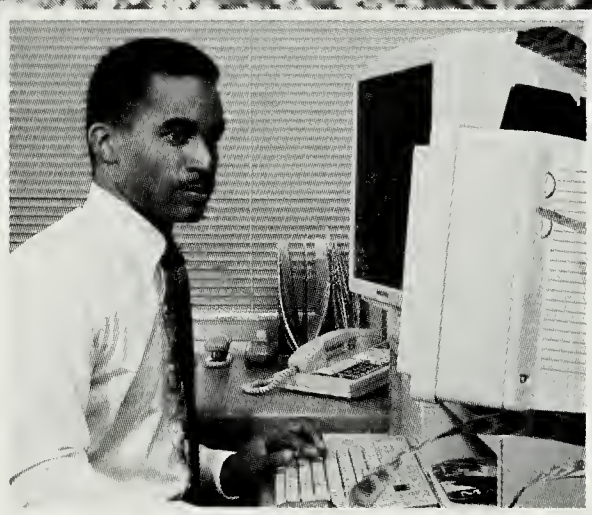

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Fullerton, CA 92634
BS in CS, EE, Math & MIS/CIS.

Radar Systems Group
P.O. Box 92426
Los Angeles, CA 90009
BS or MS in CS & EE with SW emphasis. HW background, FORTRAN, Ada, "C" languages and Realtime Systems preferred.

Research Laboratories
3011 Malibu Canyon Road
Malibu, CA 90265
PhDs (CS/IS/EE) with expertise in AI, (planning, perception or data base systems), highly parallel signal processors, systems SW.

Space & Communications Group Southern California
P.O. Box 92919
Los Angeles, CA 90009
BA or BS in CS, Math & Sys. Eng. for Realtime Prog., Telecommunications, 4 GL or Digital Design.

Space & Communications Group Colorado
16800 East Center Tech Parkway
Aurora, CO 80011-9046
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Hughes Technical Services Company
1100 Wilson Blvd., 18th Flr.
Arlington, VA 22209
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